INTERFACE AGE™

MICROCOMPUTING FOR SMALL BUSINESS AND HOME VOLUME 2,ISSUE 13, DECEMBER 1977 $1.75
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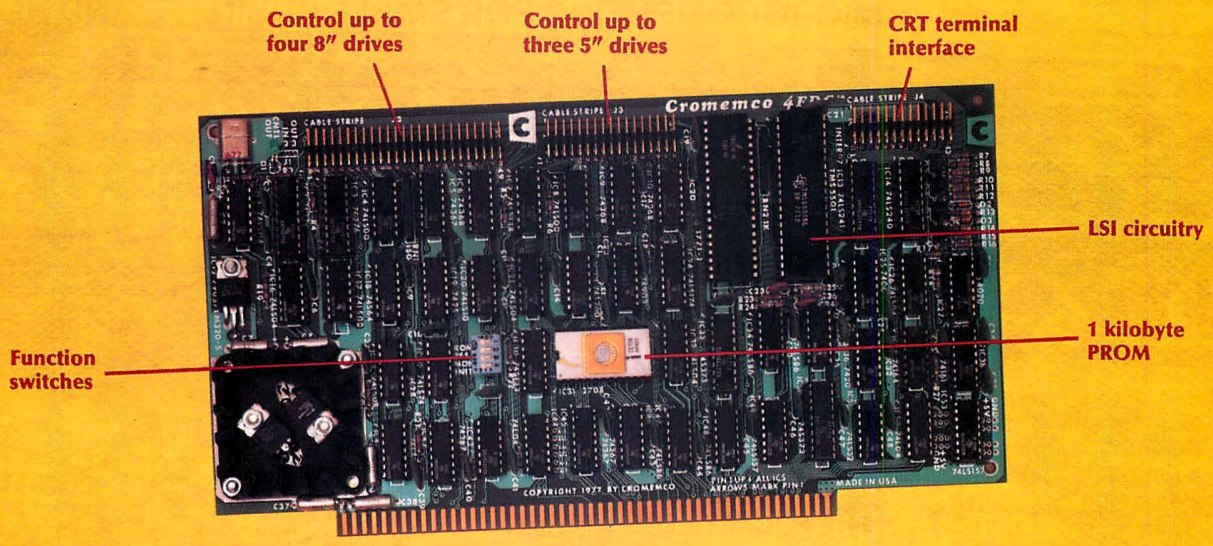

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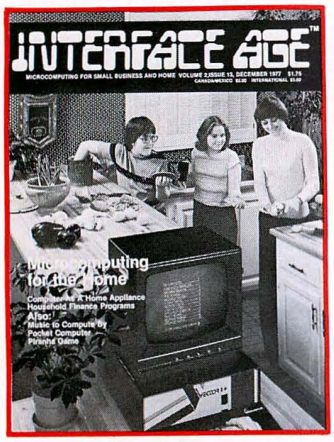

INTERFACE AGE™

MICROCOMPUTING FOR SMALL BUSINESS AND HOME

COVER STORY

This month's cover symbolizes the theme of the issue, the introduction of the microcomputer into the home. The modern-day *penate* pictured here is a VECTOR 1+, but depending on the user's personal choice it might be SOL, IMSAI, APPLE or PET.

The scene was staged in the model kitchen of Block Tops, Inc. "Mother" in this composition is posed by Kathy Saffer and the children are Julie and Ted La Mantia.

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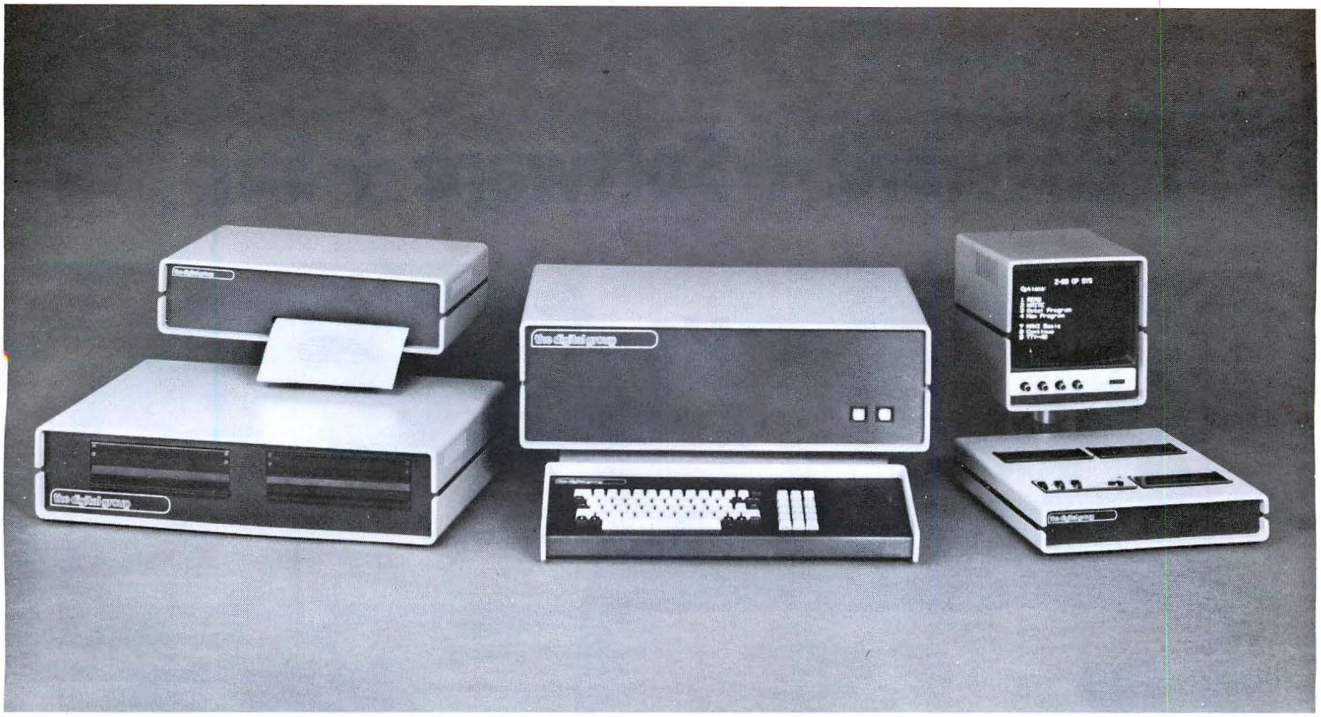

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When it comes right down to it, your computer is really only as good as its software. That's why Heath has gone to such great lengths to provide our computers with quality software packages.

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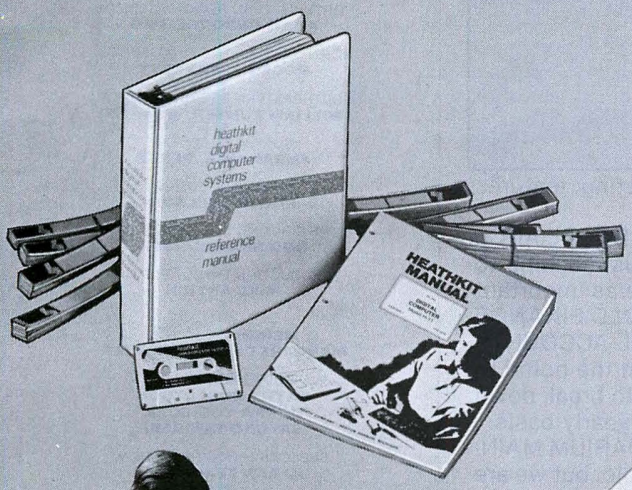

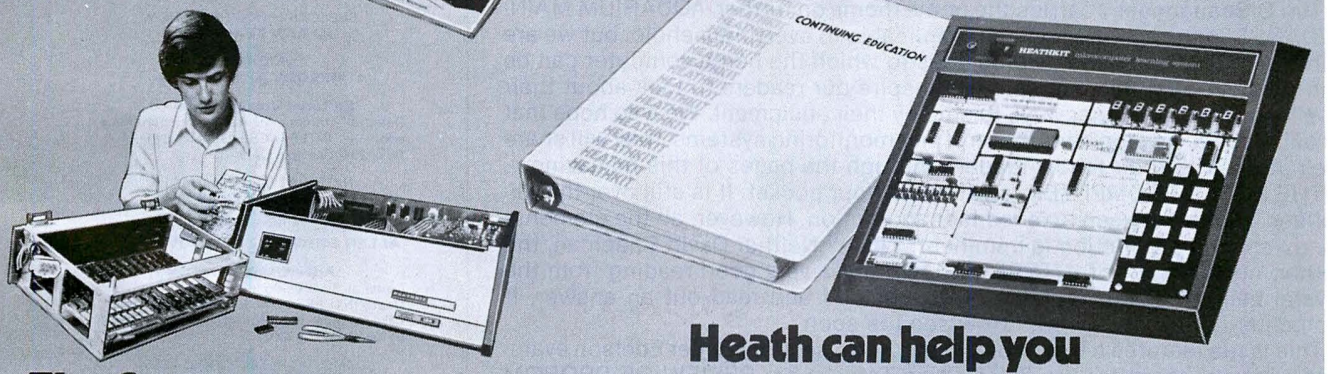

The Support...

Still learning about computers? No problem. Heath's excellent assembly manuals and checkout procedures will help you get your system up and running fast. And when you're ready to learn BASIC, our excellent EC-1100 BASIC Programming Course will teach you the fundamentals and expand your knowledge to the point where you'll be able to create your own unique programs and problem solutions. Finally, if you're interested in the electronics of microprocessors, the EE-3401/ ET-3400 Microprocessor Course and Trainer will give you a thorough working knowledge of application, operation, interfacing and programming along with valuable "hands-on" experience. With this kind of support from assembly to completed system it's easy to see why with Heath, YOU'RE the computer expert!

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INTERFACIAL

This month INTERFACE AGE, the magazine of home computing, features the microcomputer doing duty as a machine in the home.

Dian Crayne in her article THE COMPUTER AS A HOUSEHOLD APPLIANCE leads the lineup with a useful application: put the mysterious machine to work to cook dinner. Management objectives in the home are as important as in the store. Francis Ascolillo in his two articles HOUSEHOLD FINANCE SYSTEM I and II, and Kevin Redden in his article PERSONAL ACCOUNTS PAYABLE PROGRAM detail how the computer can be used in the home to plan the family budget. The three articles teach a family how to break down their expenses and record them on a monthly, quarterly and yearly basis.

Tim O'Shaughnessy carries the home theme on further. AQUARIUM MAINTENANCE is a program that is not applicable to every household, but we are publishing it to show the diverse uses to which the home computer can be put. We hope that this example will inspire our readers to look about their dwelling and to find other ways to employ their equipment. We also hope that as our readers develop home control and monitoring systems, they will share their ideas with their fellow readers through the pages of this magazine.

THE POCKET COMPUTER is yet not in your pocket. It is still over that ill-defined border between science-fact and fiction. However, all the elements are extant and production is imminent. When? Neither David Chapman, the author, nor the staff of INTERFACE AGE got a very good reading from the crystal ball. When we urged it on to uncloud and read out an answer, it momentarily flashed "Soon." How *soon* is soon?

This issue features a well-stocked hardware section. Roger Edelson evaluates a music board for the 8080. Chris Terry in his REVIEW OF PROROM BOARD reports on the kind of product and its manufacturer about which all homebrew hussars dream. The hardware section continues with four more *how to* articles, one on the Tarbell cassette interface, one on adapting the Burroughs 9350-2 terminal to your system and two circuit designs.

Our software lineup under the direction of our new Software Editor, Abe Perez, offers valuable development and game programs. We have been a magazine rich in software and will continue in 1978 to present interesting and useful articles of development, application, game and simulation programming. Abe has long experience in every type of machine and every computer language invented. His imagination is fertile, and like Roger Garrett, his mind scans the entire spectrum of technology.

Returning to the front part of the book, we felt the need to salute the Yule season with two whimsical adaptation of the holidays' best-known ballad. The English language with its dual parentage of Germanic and Latin sources can draw upon many levels of expression from the erudite to the colloquial in a manner difficult to match by its relatives. Merl Miller in his description of the Eccentric Philanthropist illustrates the point that sometimes erudition can be hilarious. In a similar spirit Jon Gauger puts his version in verse.

In this year INTERFACE AGE has grown to double its circulation and increased its book size. Our format has developed and our image is recognized. All this was achieved by hard work; publishing is a competitive field. We have enjoyed every moment of the endeavor to bring you our collection of quality articles in those past twelve issues. We've also enjoyed reading and publishing your letters and chatting with you on the telephone. We *think* we are the best book in the field, but we *know* we have the best readers.

As the year enters into the final month, we of the staff of INTERFACE AGE take the opportunity to wish you, our readers and advertisers, a happy Yule season and to thank all of you for your support of our magazine.

—L.F.-S.

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LETTERS TO THE EDITOR

Dear Editor:

I am absolutely furious! Just who do you think you are kidding with Roger Garrett's "Star Ship Simulation" article in the August issue? Must I remind you of the buildup you gave this article in your June 1977 issue:

"The August issue will have an added attraction for sky-buffs. Roger Garrett has written the ultimate space game in which all functions of the Enterprise are simulated: navigation, communications, inter- and intra-ship transportation and all manners of tactical maneuvers of enemy and Federation craft. In this game several people can play, each assuming the role of navigator, engineer and helmsman. It is written in structured pseudo-code and completely documented. Have fun playing this game."

My question is: "What game?" After a buildup like that in a previous issue, and star billing on the front cover, one would expect the great-grand-daddy of all Star Treks to be spread out before him in the August issue. Instead, we get a thinly disguised lecture on structured programming.

Right away we should have realized that we were in trouble (we readers, that is) when we read that the game would be in "structured pseudo-code." What on earth is "structured pseudo-code"? If it's some new computer language Mr. Garrett has developed, I'm sure all your readers would appreciate having him share it with us. Or at least explain it to us in an article billed as something other than "the ultimate space game."

As for the article itself, if I were the editor-in-chief, I'd have deleted all references to a "star-ship simulation" (both of them), and re-titled the article "The Theory of Structured Programming." Sounds pretty dry, doesn't it? That's funny, it describes the article perfectly.

As long as I'm here, I would also like to take apart Mr. Garrett's article as an article in its own right. First off, structured programming has no business in the personal computing world. It was designed for huge computer installations with desk after desk of programmers, some who write programs, some who modify them. In a large shop, there is no guarantee that somebody who writes a particular program will be the same somebody who is asked to make modification to it at a later date. Therefore, individual programming styles are buried through the use of "structured programming," which is basically an attempt to solve all computer problems (by problems I mean applications problems) using the same approach. Thus, programmer C does not get hopelessly lost attempting to change a program that was written by programmer B two years ago before he left the firm.

This approach obviously does not fit into the scheme of personal computing, where every computer owner more-or-less is his own programmer, as well as systems programmer, maintenance man, and end-user. Granted, with the advent of turn-key systems and sharing of computer programs via computer magazines and clubs this situation is changing somewhat, but nowhere near the degree of the deadline-oriented do-or-die big business computer installation.

Another factor is the language home computerists write in. BASIC is the *de facto* standard of the software side of personal computing, just as the Altair bus is the *de facto* standard of the hardware end. And BASIC simply does not lend itself to structured programming. This is not only my personal viewpoint, but it is also the view of several authors who have chosen to write articles on the subject for other computer publications.

And then there's modular programming. Once again, Mr. Garrett is attempting to saddle the home computerite (sic) with a programming technique designed for the large computer installation. These large shops employ modular programming — the practice of breaking up a large applications problem into several tiny chunks, or modules, as they're called — so that several programmers or programming teams may work on the same project at the same time without redundancy. By giving each programmer or team one or more "modules" to work on, the entire project is supposedly completed faster than if one single programmer or team worked on the entire problem at once. However, since most computers at home are programmed by their owners, this problem does not arise in home computing. As with structured programming, Mr. Garrett is attempting to solve problems that do not even exist at the microcomputing level. It would be much better for everyone concerned if Mr. Garrett instead directed his energies at actually producing "the ultimate space game" advertised in the June issue.

There are numerous other examples in the article that blatantly point out Mr. Garrett's preoccupation with large-scale computers. One is his several references to the Fortran language, including examples, to illustrate several of his contentions. Why not BASIC, the high-level language for the overwhelming majority of hobby computerites? Another example is an entire paragraph on an "alternative interfacing method" which is "an extremely complicated one" and as such is "not generally suitable for implementation on personal computers." Then why was it brought up at all? And finally, there's the lengthy discussion on the constraints of structured programming, in which Mr. Garrett compares structured programming to an actual high level language (BASIC). Hobby computerists who have given up the "freedom" of machine language for the "constraints" of Assembler language do so for the considerable ease in program writing Assembler affords over machine language. Likewise, a high level language such as BASIC offers an even greater ease of program writing over Assembler, at the loss of the "freedom" of Assembler. But where is the ease of program writing using structured methods that is supposed to offset the loss of "freedom" afforded by using non-structured techniques? I see none. Does anybody else?

In conclusion, the large computer installations of big business are still thrashing out among themselves the benefits/pitfalls of structured and modular programming, and are likely to be doing so for some time. I see no reason for the personal computer hobby industry to get involved in these philosophical discussions with our older brothers. Rather, we should be grateful that it is not necessary for us to concern ourselves with these matters, and that we, as hobbyists, are in complete control of our computers, and not vice-versa, as it would sometimes appear in large installations. Let us move on to more enjoyable topics, such as actually writing "the ultimate space game," only in *executable* code this time, okay?

Stephen D. Johnson
Huntington, CT

ROGER GARRETT REPLIES

Dear Mr. Johnson:

The promotional piece which appeared in the June issue was not written by me. Indeed, it was written by the Associate Editor of the magazine before they had even received my manuscript. Calling it a "game" was not my idea and was possibly a misinterpretation of a telephone conversation I had with the Associate Editor in which I described the article and at which point was only about half completed. You will notice that I never refer to the project as a "game" but rather as a simulation project. It can be *used* as a game, with certain modifications, however.

Now, before answering the rest of the comments let me explain my ideas behind writing the article. I had been writing the Star Ship program for quite some time. As I continued to add capabilities and make it more sophisticated I realized that it might form the basis for an article on structured and modular programming. I began the task of rounding it out into a suitable article and contacted INTERFACE AGE about my project. They expressed interest in it and

from that contact wrote the promotional piece that appeared in June (and which apparently got the hopes of some people quite high).

I had written the program in "structured pseudo-code." (More about that later.) I had also used modular programming techniques so it became obvious to me that I would have to explain my approaches to the simulation project or the actual code itself might not be understood. Indeed, the main thrust of the article as I developed it became the principles of program development. The actual Star Ship simulation program was used as an *example* of the implementation of these principles.

It also became obvious to me that in order fully to develop the principles and examples I would have to break the article into parts. The first part, upon which the critical remarks were made, was used to introduce the programming principles, Parts Two and Three, which appeared in subsequent issues, presented the program called the Star Ship simulation. These last two issues served two purposes: a) to provide an example of the implementation of the principles previously discussed, and b) to present a program which could be easily implemented by personal computer users and thereby give them a fully developed Star Ship simulation.

The "structured pseudo-code" is certainly not a new computer language. In the course of my job as a systems analyst and having investigated many forms of structured programming I developed a method of writing programs utilizing English-grammar-like constructions which made the programs well-structured and easily readable. The term "structured pseudo-code" has been used by others to apply to code (or a program) which is written so that it is not dedicated to any one computer language or hardware setup. Such code has appeared in several articles in the popular personal computer magazines. So it is not so surprising for me to use the term in reference to the type of code I use.

While I did not make extensive use of such code in the first part of the article there was a structured programming construct chart and an example in BASIC given. The final part of the article, Part Three, was almost completely structured code and should have sufficiently answered the question of "What on earth is 'structured pseudo-code'."

I take great exception to your contention about the place of structured programming not being within the personal computer world. Likewise for your views about modularity. I agree that the first to utilize such concepts were the programmers at large computer installations and I make no excuse for being such a user myself. But to say that methods and techniques which have been found to be useful to large system users are not applicable to small and personal computers is wrong.

Surely most personal computer programmers do not have deadlines to meet nor do they often work in team projects where each of the "modules" must fit together and such a technique as modularity is required to facilitate the interfaces. But look at the popular personal computer magazines such as INTERFACE AGE and notice how many programs are being published. Quite a few. And it is undeniable that many personal computer users exchange programs. How many programmers do you know who

can resist making changes to someone else's program to make it run faster or more efficiently or to add fancy little embellishments? Very few I suspect.

Accepting such principles as structuring and modularity makes these additions and changes just that much easier. Even when the original author of the program is first developing it, it is so much easier to locate errors when he can narrow it down to a section (module) rather than wading through a massive string of equations and GOTOs.

Also consider the fact that many hobbyists are junior high, high school, and college-age students. Often the personal computer is their first exposure to programming. This will certainly become more and more the case as Heath, Radio Shack, and PET computers become more popular. Many of these first-time users will be the programmers and systems analysts of the future, or at least will continue as serious hobbyists into later life. I think Linda Folkard-Stengel, the Associate Editor, put it perfectly when she said in the Interfacial section of the August issue that learning structured programming at the beginning of the programmer's education is comparable to learning the fundamentals of English grammar and syntax before trying to express one's self in an essay. You can try writing from "motivation" or "intuition" but until you really understand the tools, the methods of writing, then you will not produce a work of literature or a sensible, workable program which can easily be understood by others or even easily be modified or debugged by yourself.

So it is a tool, and it has just as much applicability to the sometimes personal computer programmer as the huge installation systems analyst.

"BASIC does not lend itself to structured programming." Alright, I'll agree to that. But then no language which does not have all of the standard structured programming constructs (IF-ENDIF, REPEAT UNTIL, etc.) actually *lends* itself to structuring. You must make do with what is available, and if BASIC is what you have then use it. The *concepts* of structuring and modularity can still be applied.

BASIC has only become the *de facto* standard for hobbyists because it was first. There is now available such languages as FORTRAN and PL/1. With the advent of 16-bit and larger computers becoming available to personal users even more powerful languages and, who knows, maybe even a full structured modular language may be developed. Until that time we use what we have; both the languages and the tools for implementing them.

My reference to alternative interfacing methods was simply to indicate that there *were* alternatives so that the reader would not think there was only that one way. I wanted to avoid implying that there was a limit to the way in which the program could be implemented.

I still maintain that structuring frees the programmer to concentrate more on creative program development and less on the constraints of a particular language. This should be evident from the logic flow definitions in the third part of the Star Ship simulation. But then, Mr. Johnson, you wrote your letter to the editor before the second and third parts were published.

Surely we hobbyists are in complete control of our computers. I do not see the industry discussions of the benefits of structuring as "philosophical." Rather they are of the form either "I'm happy with the way I do things and am not about to change" or "I'm not yet convinced it does all it is reported to do." This last statement, I find, is most often stated by those who have heard outlandish claims about the benefits of structuring. Some would have us believe it is the universal cure-all. It is not, and I hope that I did not give that impression. It is a tool, and like any tool, for some it will be useful, for some, not. In either case it is worth giving it a fair trial by actually using it. Obviously I have found it useful and believe that it can make programming a more enjoyable and rewarding hobby and occupation.

One last word about publishing programs in a particular programming language. There is no universally accepted computer language. Without such a language how does a writer choose a language which will be applicable to the majority of users? Certainly BASIC is understood by most hobbyists. But then what about the fellow who wants to implement the published program in 8080 machine language, or APL, or whatever he has available? Obviously he must then know two languages, the one in which the program is published and the one in which he wishes to implement it. And he also must have a good idea of how to accomplish the transformation. This involves not only knowing the grammar and syntax of each language but also knowing such things as the particular idiosyncrasies of the particular "brand" of the language. MITS BASIC is not identical to Commodore's BASIC.

The solution, then, I feel, is to publish the programs in a structured pseudocode, written in English-grammar constructions. The programs would not be dedicated to any particular brand of BASIC (or whatever language you have) nor would it be for a specific hardware implementation. In this form it would be most flexible and more readers could make use of it.

Roger C. Garrett

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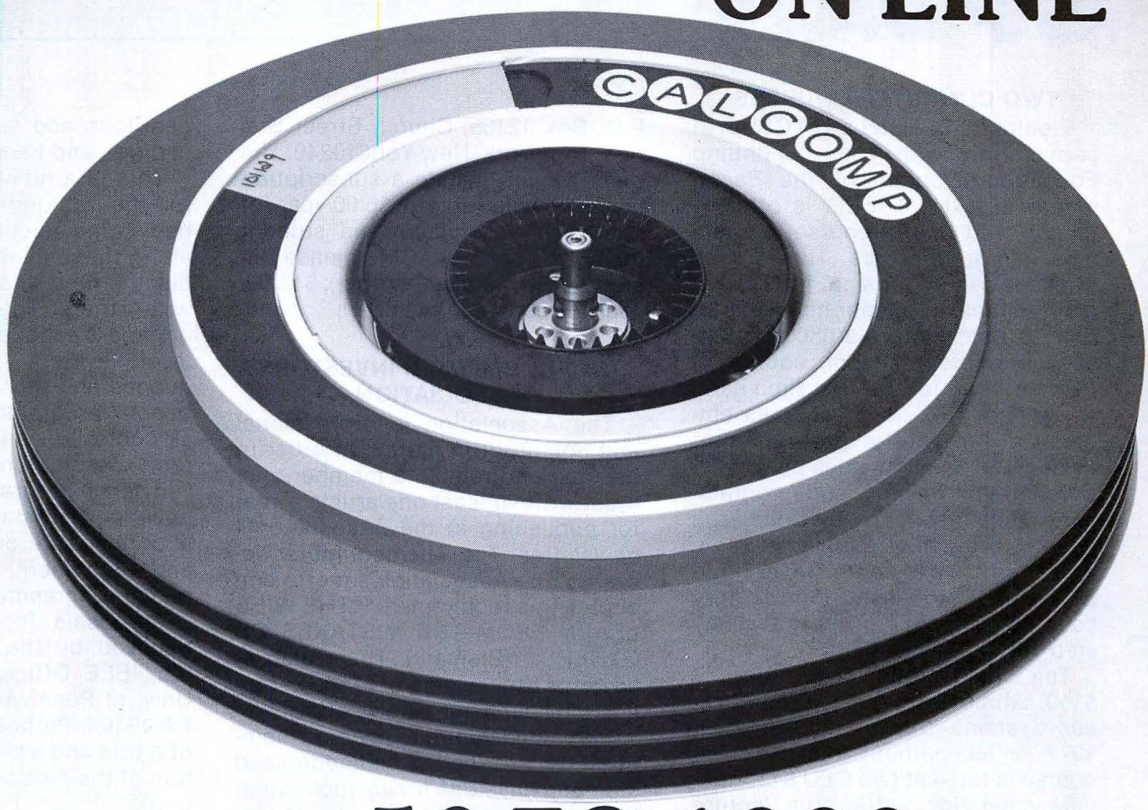

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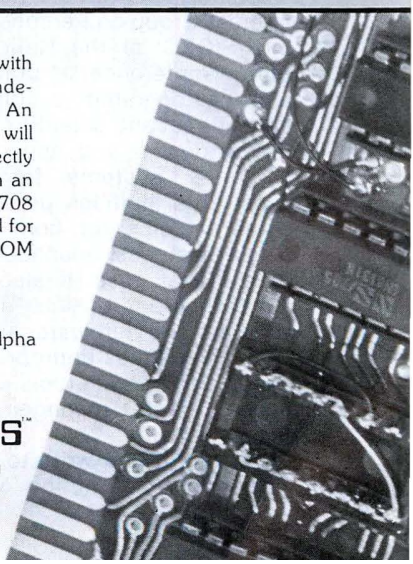

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TWO COMPUTER COURSES

Electronic Design Lab of CSUS, in cooperation with the Continuing Education Program of the Sacramento Section of IEEE, is offering for the fifth time a course in basic 8-bit microprocessors. This course stresses system design, interfaces, and practical applications of the Intel 8080 and Motorola 6800. An advanced microprocessor course is being offered for the first time early in January 1978. Both courses emphasize laboratory programming throughout an eight week period. By allowing for reading and programming time between sessions, the courses offer an attractive, inexpensive alternative to short, two or three day single processor introductory courses frequently given in the Bay area and other locations.

The basic course has a fee of $110, which includes *Microprocessor Systems Design* by Klingman 1977, or $90 without this text. The course is rated at two CEU's (continuing education units). The lecture will meet at CSUS in engineering room 1102, and the lab in room 1112.

The advanced class fee of $100 includes copies of numerous microprocessor handouts. The class meets in the same rooms and is rated at 2 CEU's also. In either case, no prior registration is necessary. Fee payment, or other arrangements, will be taken care of at the first lecture. Checks should be made out to the Foundation of CSUS. The lecture and lab instructor is Ron Becker, 454-6873.

ACM SPECIAL INTEREST GROUP ON PERSONAL COMPUTING

The Association for Computing Machinery chartered a new Special Interest Group on Personal Computing, SIGPC, at the National Computer Conference in June. SIGPC will be operated exclusively for educational and scientific purposes in the design and applications of computer systems for personal uses. This includes personal computer systems for home, clerical, small business, management and recreational uses. It also includes the technology of such systems in software and hardware, and emphasizes techniques appropriate to the integration of such tools a graphics, speech, data management, and music systems.

To join SIGPC write to the Association for Computing Machinery, P.O. Box 12105, Church Street Station, New York, New York 10249. The dues (which include a subscription to the newsletter) are: $5.00/year for Members, associates, and student members of the ACM (please include ACM member number); $13.00/year for non-ACM members.

MICROCOMPUTER INVESTORS ASSOCIATION

The Association is professional and non-profit in nature. In order to become and remain a member, one must write at least one article a year for publishing in the Association's newsletter, *The Microcomputer Investor.* The Association's motto embodies this requirement: "THE WISE LEARN FROM THE MISTAKES OF OTHERS." (Bismark). There also is an initial assessment of $15 to defray costs of publishing newsletters.

Persons desiring to become members should send a self-addressed stamped envelope for an application form to: Jack Williams, The Microcomputer Investors Association, 2415 Ansdel Court, Reston, VA.

CALL FOR PAPERS MIMI '78 — ZURICH

The Fourth International Symposium and Exhibition Mini- and Microcomputers and their Applications — MIMI '78 Zurich is to be held June 12-15, 1978 in Zurich, Switzerland. Sponsored by the International Society of Mini- and Microcomputers (ISMM), MIMI '78 covers all aspects of mini-, micro-, modular and meta computers and their applications including hardware, software, technology, networks, distributed processing, development aids, systems, education, peripheral devices, personal and home computers, data acquisition and processing, instrumentation, control and others. Three copies of a 200-250 word abstract should be submitted by February 1, 1978 to Secretariat MIMI '78, Interconvention, c/o Swissair Postfach, 8058 Zurich, Switzerland.

μPIEEE '78 — CALL FOR PAPERS

As in 1977, this Workshop will explore bench programming methods — design of microprocessor-based equipment without capital investment. The Workshop will deal with proven alternatives to $20K disc-and-terminal development systems and time-share cross-assemblers. This is a continuing search for more expeditions and less error-prone procedures and hardware.

This is a no-nonsense Workshop for the working engineer who has had some successes and failures along these lines, and would like to discuss and share his experiences with others. The following classes of papers suggest themselves: High-level (system) programming languages and techniques suitable for bench programming; single-board μP controllers and development systems: Assist-function boards; proven bench-programming procedures; new coding languages; trouble-shooting and debugging methods and equipment; case histories of bench-programmed products.

Proposals for papers are being received by the μPIEE-78 Committee, IEEE Office, Moore School of Univ. of Pennsylvania, Philadelphia, PA 19104. Proposals should consist of a title and a brief (10 line) description of the proposed paper. After the proposal has been approved, the paper itself will not be due until February 15, 1978. This procedure is designed to provide maximum possible time for working up the paper.

Proceedings of μPIEE-78 will be mailed to participants prior to the Workshop. Last year's Proceedings of μPIEEE-77 (IEEE Cat. No. EHO 125-5) are available at $20 from IEE Piscataway or from IEEE Philadelphia office at the above address.

SHORT COURSE, SEMINAR

Integrated Computer Systems, Inc. has schedules the following sequence of intensive microprocessor and microcomputer short courses. The weekly sequence will include the following subjects: Monday—Microprocessor Project Management, from Design through Manufacture, QA and Field Service (#111); Tuesday—Microprocessors and Microcomputers, a Comprehensive Technical Introduction and Survey (#102S); Wednesday-Thursday—Hands-on Microcomputer Programming Workshop (#125); Friday—Hands-on Interfacing Workshop (#136).

The course will be held during 1978 in the following cities on dates listed below:

Los Angeles	January 16-20
Houston	January 23-27
Detroit	February 6-10

Denver	February 13-17
Boston	March 6-10
San Diego	March 13-17
Ottawa	April 3-7

Courses can be taken individually or in combination. Tuition costs range from $195 for a one-day course to $695 for the complete sequence. For information, contact Integrated Computer Systems, inc., 3302 Pico Blvd., 2nd Floor, Santa Monica, CA 90405, (213) 559-9265.

COMPUTER NETWORKING SYMPOSIUM

The advance program for the Computer Networking Symposium is now available. The Symposium, co-sponsored by the IEE Computer Society and the National Bureau of Standards, will be held in Gaithersburg, Maryland, December 15, 1977. The planning, implementation, evaluation and use of both large and small scale computer networks will be explored. Important technical advances will be reported and the progress of existing networks will be reviewed. For a copy of the advance program write to COMPUTER NETWORKING, PO Box 639, Silver Spring, MD 20901, (301) 439-7007.

CALL FOR PAPERS

A Personal Computing Festival will share the public spotlight in conjunction with the 1978 National Computer Conference to be held June 5-8 in Anaheim, California. A Call for Papers has been issued for the Festival Program which will be held June 6-8 at the Disneyland Hotel adjacent to the Anaheim Convention Center. Included as part of the three day program will be presentations of invited papers, contributed papers, tutorials, as well as panel discussions relevant to personal computing. Letters of intent to participate as either an author, panelist or session chairman must be submitted by February 1, 1978. Authors who have received notification of acceptance must submit final papers by March 15, 1978 in a specified camera-ready format.

Topics sought are: tutorials for computer novices; speech synthesis and speech recognition; computer-driven and computer-assisted music systems; computer graphics and video art; personal computers for the physically disabled; personal computers for education; business systems using "home" computers; hardware and software design and implementation; standards for hardware, interfaces and software.

Papers presented during the Festival Program will be published in a softbound book, *Festival Digest '78,* which will be available during the NCC.

Information on NCC '78 may be obtained from AFIPS, 210 Summit Ave., Montvale, NJ 07645, (201) 391-9810.

CALL FOR PAPERS

A call for papers has been issued for the Eighth International Symposium on Multiple-Valued Logic, which will be held May 24-26, 1978, in Chicago. The event is co-sponsored by the IEEE Computer Society, the Illinois Institute of Technology, the Office of Naval Research and the ACM. Authors are invited to submit original unpublished research, survey, or tutorial papers on the theory and applications of multiple-valued logic in the following areas: algebraic and formal aspects of multiple-valued logic; logic design and switching theory; probabilistic, variable-valued, and other multiple-valued systems; automated design; languages and language processing; applications in exact reasoning to knowledge based systems; programming logic and man/machine systems; circuit implementations; philosophic aspects; fault detection and diagnosis, and reliable design; applications in digital systems; and other relevant topics of interest.

Both regular and short papers are solicited. Authors of regular papers should submit four copies of a 50-100 word abstract as well as a full draft with figures (typed double-spaced and not to exceed 20 pages). Authors of short papers should submit two copies of a summary (no more than 500 words, typed double-spaced). All material is due *December 16, 1977,* and should be mailed to Dr. Robert E. Swartout, program chairman, Electrical Engineering Department, West Virginia University, Morgantown, West Virginia 26506; (304) 293-3880.

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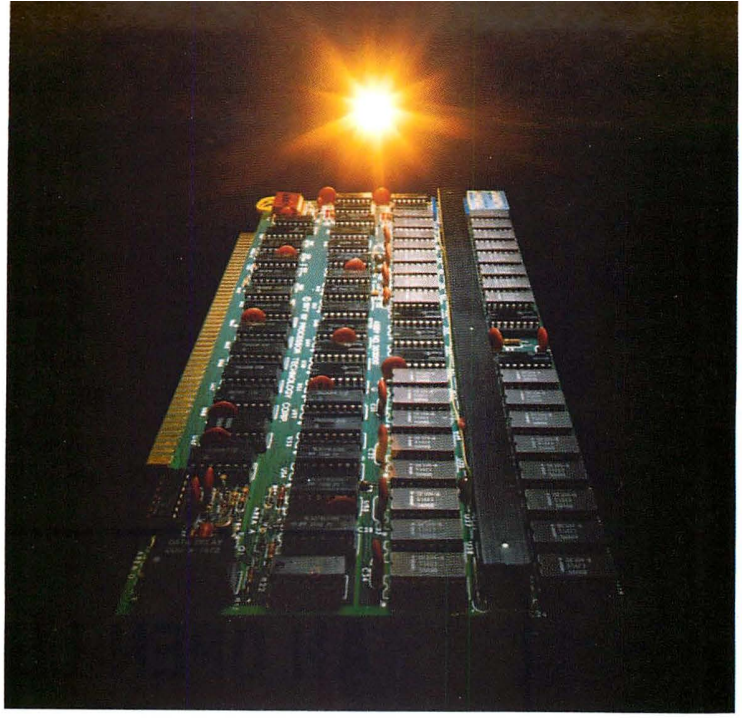

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Let's face it. Loading and soldering PC Boards is not much fun for the kit builder. Even more important, it's the place where most of the trouble gets introduced. The real fun and education comes in running and testing boards.

Now the Semikit with fully tested IC's.

At the price of a kit, Processor Technology Corporation introduces the Semikit. It's a fully stuffed, assembled and wave soldered PC Board loaded with IC's that have gone through Q.C. and final check-out (a first in the industry).

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The 16KRA Memory is Processor's first step in adding more fun, capability and reliability to your computer system at lower cost. Other modules are on the way to your dealer now. Come on down today.

Or you may contact us directly. Please address Processor Technology Corporation, Box G, 7100 Johnson Industrial Drive, Pleasanton, California 94566. Phone (415) 829-2600.

Processor Technology

CALENDAR

JANUARY

Jan 3 Tidewater Computer Club will hold its meeting at the Electronics Computer Programming Institute, Janaf Office Bldg., Janaf Shopping Center in Norfolk. For further information contact: C. Dawson Yeomans, Interface Chairman, 677 Lord Dunmore Dr., Virginia Beach, VA 23462.

Jan 4 New England Computer Society will meet in the cafeteria of the MITRE Corp. at 7:00 P.M. Located on Route 62 in Bedford, MA. Contact Dave Day at (603) 434-4239 for details.

Jan 4 Kitchener Waterloo Microcomputer Club will meet at the University of Waterloo, Room 3388, Engineering Bldg. #4, University Ave., Waterloo, Ontario, Canada at 7:30 P.M.

Jan 4 Northwest Computer Society will meet in the Pacific Science Center in Seattle, Room 200 at 7:30 P.M. For more details write NCCN, Box 242, Renton, WA 98055.

Jan 4 The Valley Computer Club will meet at the Harvard School at 7 P.M. The Harvard School is located at 3700 Coldwater Canyon, Studio City, CA.

Jan 4 Lincoln Computer Club will hold its meeting at the South Branch Library located on 27th and South Streets. The time of the meeting is 7:00 P.M. For further information contact Hubert O. Paulson, Jr., 422 Dale Dr., Lincoln, NE 68510.

Jan 5 Bay Area Microprocessors Users Group (BAMUG) will meet in the Hayward ROC Center, 26316 Hesperian Blvd., Hayward, CA at 7:30 P.M. For further details write BAMUG, 1211 Santa Clara Avenue, Alameda, CA 94501.

Jan 6 Crescent City Computer Club will hold its meeting at the University of New Orleans, Lakefront Campus at 8 P.M. Call Bob Latham at (504) 722-6321 for more details.

Jan 7 Louisville Area Computer Club (LACE) will meet at the University of Louisville, Speed School Auditorium at 1 P.M. For further information, write the club at 115 Edgemont Drive, New Alban, IN 47150.

Jan 7 The Computer Hobbyist Group, will meet at 1 P.M. in Green Center, Room 2.530, campus of University of Texas, Dallas. For further information write the club at P.O. Box 11344, Grand Prairie, TX 75051.

Jan 7 South Central Kansas Amateur Computer Association, 9:00 A.M., Wichita Public Library, Wichita, KS. For further information call Chris Borger at (316) 265-1120 or Dave Rawson, 1825 Gary, Wichita, KS 67219, (316) 744-1629 for further details.

Jan 7 Oklahoma Computer Club will hold its meeting at the Belle Aisle Library at 10:00 A.M. Call Al Campbell at (405) 842-4933 for details.

Jan 7 Southern Nevada Personal Computing Society will meet at Clark County Community College, Las Vegas, NV at 12:00. For further information write SNPCS, 1405 Lucille St., Las Vegas, NV 89101 or call (702) 642-0212.

Jan 7 Milwaukee Area Computer Club will meet at 1 P.M. at the Waukesha County Technical Institute, New Berlin, WI. Call (414)

246-6634 for further details.

Jan 9 Minnesota Computer Society will meet at the Brown Institute, Room 51, 3123 E. Lake Street, Minneapolis, MN. For further information contact the Society at Box 35317, Minneapolis, MN 55435, Attn: Jean Rice.

Jan 12 Mid America Computer Hobbyist meeting will be at 7:00 P.M. at Commercial Federal Savings & Loan, Bellevue NE. Intersection of Galvin Rd. and U.S. Hwy. 73-75. Write P.O. Box 13303, Omaha, NE 68113 for further information.

Jan 12 Utah Computer Association will meet at Murray High School, Rm 154, 5440 S. State St., Salt Lake City, UT at 7:00 P.M. For further information write or call Larry or Holly Barney, 1928 S. 2600 E., Salt Lake City, UT 84108. (801) 485-3476.

Jan 12 The Rochester Area Microcomputer Society will meet at the RIT Campus, Rm. 1030, Bldg. 9 at 7:30 P.M. For details write RAMS, P.O. Box D, Rochester, NY 14609.

Jan 13 Northern New Jersey Amateur Computer Club (NNJACC) will hold its meeting at the Fairleigh Dickenson University, on the Rutherford Campus, Becton Hall, Room B8. This meeting will begin at 7:00 P.M. For more information contact NNJACC, 593 New York Avenue, Lyndhurst, NJ 07071.

Jan 14 The Permian Basin Computer Group—Odessa Chapter meets at 1 PM in the Electronic Technology Bldg., Room 203 on the Odessa College campus. For further information call (915) 332-9151.

Jan 15 North Orange County Computer Club will have its meeting at Chapman College, Orange, CA. Doors open at 12:00. 105 Hashinger Hall Auditorium. Membership Chairman, Tracey Lerocker, (714) 998-9722 evenings.

Jan 17 Sacramento Microcomputer Users Group, (SMUG), 7:30-9:30 P.M. at SMUD Training Bldg., 59 St. between Folsom and "S" Sts. Write Richard Lerseth, P.O. Box 161513 or call (916) 381-0335 after 5:00 P.M.

Jan 17 Tidewater Computer Club will hold its meeting at the Electronics Computer Programming Institute, Janaf Office Bldg., Janaf Shopping Center in Norfolk. For further information contact: C. Dawson Yeomans, Interface Chairman, 677 Lord Dunmore Dr., Virginia Beach, VA 23462.

Jan 18 Homebrew Computer Club meeting will begin at 7 P.M. in Menlo Park, CA. The Stanford Linear Accelerator Center Auditorium is the site of the meeting. Call (415) 967-6754 for details.

Jan 20 Long Island Computer Association will meet at the New York Institute of Technology, Old Westbury Campus, Route 25A between Route 107 and Glen Cove Rd., Rm. 508. The time of the meeting is 7 P.M. For further information, write Long Island Computer Association, 36 Irene Lane East, Plainview, NY 11803.

an 20 Amateur Computer Group of New Jersey (ACGNJ) will meet at UCTI, 1776 Raritan Rd., Scotch

Plains, NJ 07076 at 7 P.M. For further information write to the club at the above address.

Jan 21 San Diego Computer Society will meet at the Grossmont Community College Student Center, 8800 Grossmont College Dr., El Cajon, CA. Doors open at 12:30. For details call (714) 565-1738.

Jan 21 The 7C's Committee (Affiliated with the Cleveland Digital Group) will meet at Cleveland State University Student Services Bldg., in the Kiva Room at 2:00 P.M. For more information write to Cleveland Digital Group, 8700 Harvard Ave., Cleveland, OH 44105.

Jan 22 Chicago Area Computer Hobbyist Exchange (CACHE) will meet at 12:00 P.M. in the Nigas Bldg. Cafeteria. The Nigas Bldg. is located on Schermer Rd. in Glenview, IL. Call CACHE Hotline (312) 849-1132 for details.

Jan 22 Central Florida Computer Club will meet at the Orlando Utility Bldg., on S. Orange Ave., Orlando, FL at 2:00 P.M.

Jan 25 Diablo Professional Users Group (DPUG) will meet at Diablo Valley College Library, from 8-10 P.M. DVC is near the Willow Pass exit of Fwy. 680. For details write or call Bob Hendrickson, Electronics Dept., DVC, Pleasant Hill, CA 94523; (415) 687-8373.

Jan 25 Boston Computer Society will hold its meeting at the Commonwealth School, 151 Commonwealth Ave., Boston at 7 P.M. The school is located on the corner of Dartmouth St. in Boston's Back Bay, one block from the Boston Public Library and the Copley MBTA Stop. For information write or call Boston Computer Society, 17 Chestnut St., Boston, MA 02108, (617) 227-1399.

Jan 26 Space Coast Microcomputer Club will hold its meeting at 7:30 P.M. at the Merritt Island Library, Merritt Is., FL. Contact Ray Lockwood at (305) 452-2159 for details.

Jan 26 Small Computer Engineering Association of Minnesota (SCEAM) will meet at the Resource Access Center, 3010 Fourth Ave. So., Minneapolis, MN 55408 at 7 P.M. For more information write to this address or call (612) 824-6406.

Jan 27 Alamo Computer Enthusiast meets at 7:30 P.M. in Room 104 at Chapman Graduate Center at Trinity University, San Antonio, TX. For details call (512) 532-2340, or write to the club at 7517 Jonquill, San Antonio, TX 78233.

Jan 27 Washington Amateur Computer Society has scheduled its meeting to be held at the Catholic University of America, St. Johns Hall. Located at Michigan and Harewood Aves. in Washington, D.C. Contact Bill Stewart at (202) 722-0210 for club details between the hours of 10 A.M. and 12 P.M.

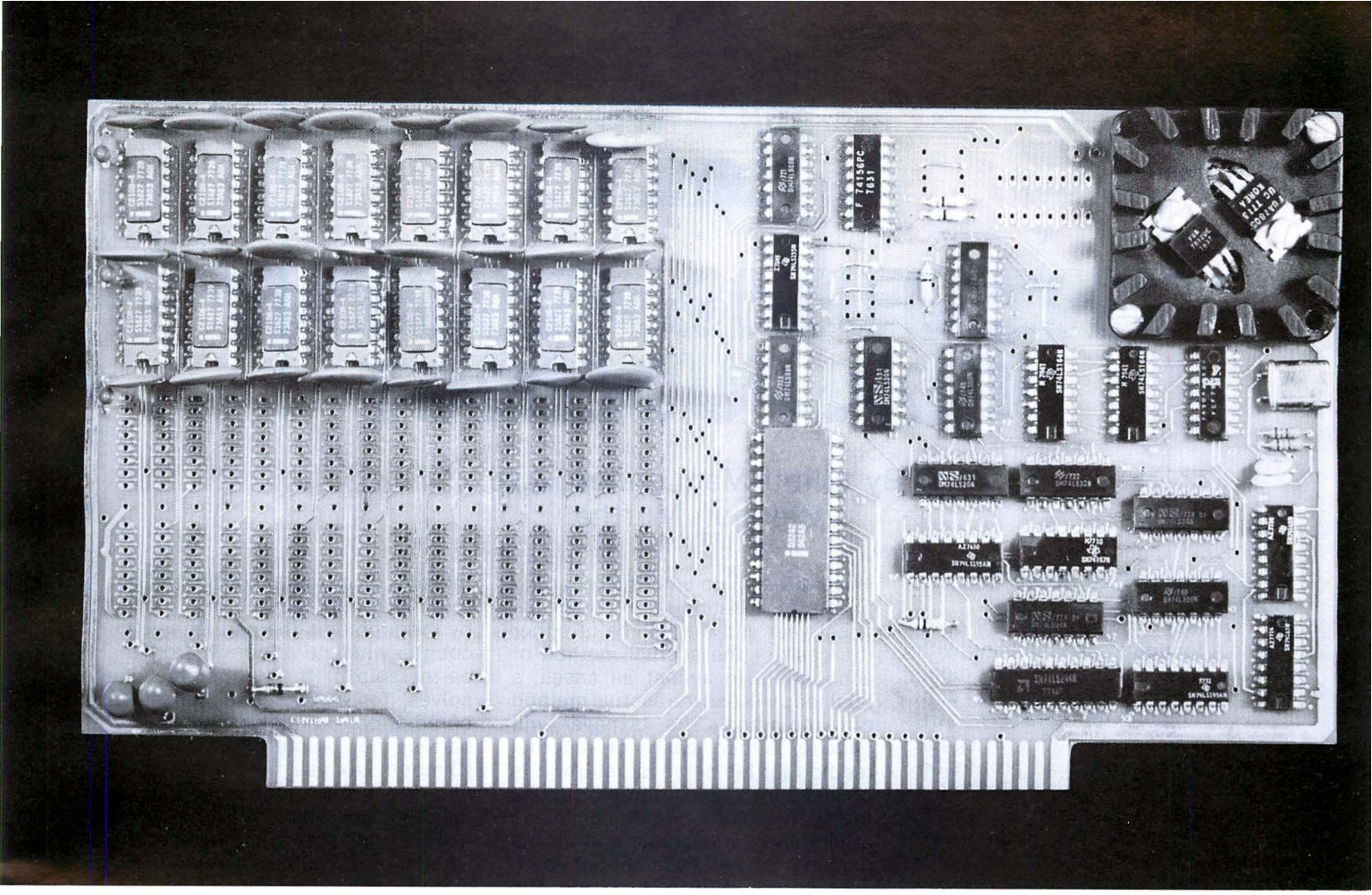
Jan 27 University of Minnesota Microcomputer Users Group (UMMUG) will hold its meeting at the University of Minnesota, Electrical Eng. Rm. 115 at 7 P.M. For further information write UMMUG, Dept. of Elec. Eng., 123 Church St. S.E., Minneapolis, MN 55455.

Jan 27 Trace will hold its meeting at the Ontario Science Center, 2:00 P.M., 770 Don Mills Road, Don Mills, Ontario. Club address is Box 545, Streetsville, *Ontario*, Canada L5M 2C1.

Jan 29 Summit City Computer Club will meet at the McMillen Library on the Indiana Institute of Technology Campus in Fort Wayne, IN. For further information write the club at P.O. Box 5096, Fort Wayne, IN 46805.

Jan 29 Birmingham Microprocessor Group will meet at Southcentral Bell Company headquarters bldg. at 2 P.M. For further details write or call Jim Anderson, 2931 Balmoral Rd., Birmingham, AL 35223; (205) 897-9630.

Jan 31 Computer Amateurs of South Jersey will holds its meeting at the National Park Municipal Bldg., 7 South Grove Ave., National Park, NJ, at 7:30 P.M. For further information call (609) 541-1010, or (609) 541-8296.



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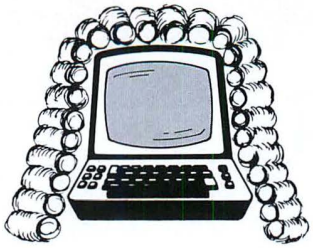


THE JURISPRUDENT COMPUTERIST

By Elliott MacLennon, J.D.
Stephan Murtha

SOLE PROPRIETORSHIPS AND PARTNERSHIPS

The next four columns will comprise a four-part series dealing with some of the more specific tax, legal, and planning considerations concerning sole proprietorships, partnerships and corporations. This column will deal with sole proprietorships and partnerships. The next will deal with Subchapter S corporation (taxed once), and the final two columns of the series shall deal with the Subchapter C corporation (taxed twice).

The sole proprietorship and partnership provide the least opportunity for tax savings as compared with corporate structures. Their principal advantage is that they have fewer paperwork transactions than do their corporate relative. By definition, the sole proprietorship is simplest to operate. A partnership, however, has the flexibility that the sole proprietorship does not, for in the former, one partner can act for all, whereas in the latter, only one person is ordained with managerial decision power. *Both a sole proprietorship and a general partnership can be created orally in California.*

Both serve essentially as a conduit to funnel income to the individual owners for inclusion on their tax returns. As such, sole proprietorships and partnerships pay no taxes on their own. A sole proprietor simply lists his income and corresponding business deductions on form 1040. A partnership, while it pays no taxes, does file a return, a form 1065, which apportions the income of the partnership up between the partners. Each partner then reports his share of the income on his form 1040 and pays the appropriate tax.

There are two tax planning devices which have to do with the reporting phase of taxation; the choice of fiscal year and the choice of either the cash or the accrual method of accounting. In almost all cases, a business will use the accrual method of accounting. The taxpayer will choose either cash or accrual method for his personal return. It is possible for a sole proprietor to use the accrual method for his business affairs and the cash method for his personal affairs even though both are reported on the same return. The basic advantage of the cash reporting method is that a taxpayer need not report income for tax purposes until it is actually or constructively received by him or her. As a rule, only special business entities use the accrual method. There, income is taxable when earned, whether taxpayer has received the income is of no consequence.

The second device is the choice of a fiscal or calendar year reporting period for income. The sole proprietor must have the same tax year as his business. A partner may choose a different tax year than the partnership, only where the partner owns no more than a 5% capital interest in the partnership unless the partner gains pre-approval from the taxing authority.

By choosing different tax years, some deferment of taxes may be accomplished. For example, by entering into a partnership on February 1, 1977, with a fiscal year ending January 31, the taxable income reportable in 1977 would be limited to income earned in January of 1977. The income of the partnership would be reported on January 31, 1978, and reported on the partners' 1978 form 1040. Taxes would be due on April 15, 1979. In some situations, this may be advantageous. However, this advantage may be outweighed by the problems the partner will encounter when he withdraws from the partnership or the partnership dissolves, for instance, to become a corporation. In that instance, the partner may be put into a one time 23-month tax year which may push him into a much higher tax bracket than is acceptable.

One final note on the reporting aspect of taxation: quarterly estimated taxes. As an employee, an individual has taxes withheld from his paycheck by his employer. The IRS has certain rules and regulations dealing with withholding taxes, and if you have employees, you should check with your accountant to be sure you comply with the law.

Self-employed individuals have no one to withhold taxes for them, so they must file a quarterly declaration and payment of estimated taxes. This involves simply estimating annual income on a quarterly basis and paying the appropriate tax on that amount of income. It is technically not necessary to file the statement if you are self-employed, but if at the end of the year you have not paid enough in taxes, there is a 7% penalty assessed on the deficiency.

There are a number of tax items which receive special treatment in the reporting of income for a sole proprietorship or partnership. They are capital gains and losses, charitable contributions, dividends from most domestic corporations, recovery of bad debts, non-business expenses, items subject to a special allocation different from the allocation of profits and losses, etc. The sole proprietor simply makes the adjustments and then reports the income, losses, or deductions on a

form 1040.

A partnership must separate out these items from the other income on the form 1065 and these items are reported separately on the partner's individual tax return.

Another item which causes much confusion, from a tax point of view, is employee benefits such as group insurance and retirement plans. If you have employees, any contributions or premiums which you pay for their benefit, are tax deductible. However, for everything except retirement plans, the premiums or contributions made on behalf of the sole proprietor or partner are not deductible.

The sole proprietor or partner has two types of retirement programs available, the Keogh or HR-10 plan and the IRA or Individual Retirement Account. The contributions to a Keogh plan are deductible up to 15% of compensation or $7,500, whichever is less. In order to make this contribution, all employees who have been employed for 3 years or more must have equal, in percentage of income, contributions made on their behalf. The Qualified Corporate Plan, available only to the corporation that is taxed twice, is vastly superior.

The sole proprietor or partner may set up an IRA for himself in lieu of a Keogh plan. In that case, the contribution is limited to the lesser of 15% of compensation or $1,500. However, the contribution is deductible, regardless of how many employees there are or how long they have been employed.

We will cover in more detail what solutions are available to the partner or sole proprietor who has a tax problem in the article of corporations. However, there are two items worth considering at this time. The first involves funneling income to family members. For example, the owner of a business is making a profit of $200,000 per year before taxes and he had five members in his family. The after tax results of his paying tax on $200,000 are much less desirable than for each member of the family to report $40,000 of that income, file an individual return, and pay taxes on that income. The reason for this is the progressive nature of our tax structure. In order to limit this type of situation, the Congress has passed various provisions dealing with family partnerships. Basically, a partnership cannot distribute income to family members in a way that is substantially different from their capital contributions. In summary, a family partnership is a means of reducing the overall tax burden to the principal income producer by having income that would otherwise be taxed to him taxed to members of his family as their presumably lower tax brackets.

Partnerships are not difficult to create from a legal perspective. From a tax point of view, partnerships can be without question the most complicated structure with which to work.

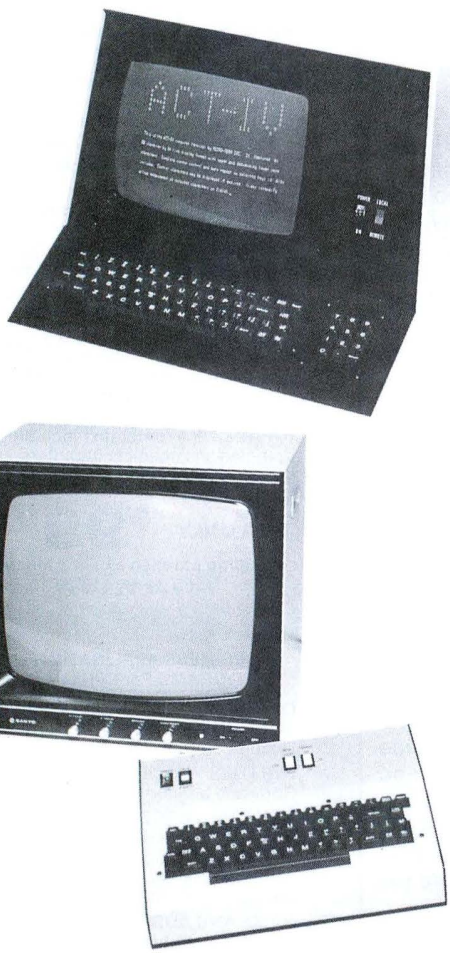
The second item has to do with the question of whether to incorporate or not. In some cases, an individual making an extremely high income may be better off not incorporating or by incorporating under Subchapter S which will tax him only once. If the income is the result of personal effort, rather than investment income, the maximum tax rate is 50%. Since a corporation is also taxed at 50% and any subsequent distribution of income or the sale of stock is a taxable event, the individual may be better off not incorporating and limiting the tax rate on income to 50%.

Although as earlier mentioned, sole proprietorships and general partnerships require little or no legal documentation. Unfortunately, for example, an oral partnership does not provide for partner's responsibilities and perhaps of even more importance, it does not provide for a smooth transition occasioned by the disruption of a deceased, disabled, retiring, withdrawing, or expelled partner. Where the partnership has a value because of its success, a funding mechanism is essential to handle a departing or deceased partner's interest. Insurance or a sinking fund are old tried-and-true work horses in this area. Of the two, where applicable, insurance is superior because a general partnership, like its simpler relative the sole proprietorship, is no shield from legal liability as is a corporation; therefore, the money put aside for a sinking fund is exposed and ripe for a liability attack.

If your plan is to raise capital for your business, the sole proprietorship and general partnership are extremely poor vehicles.

Hopefully as this series of articles progresses, two points will emerge as paramount. One, failure to coordinate your legal and tax and liability planning will almost always guarantee you a catastrophe at some undetermined point in the life of your business. Two, the decision to make a given tax decision is tactically never absolute. Tax elections are therefore not hard and fast, rather decisions written only on sand and subject to the rapidly changing winds omnipresent in the business climate in which a given business operates.

Either,...Or a choice in ACT-IV



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A VISIT FROM ST. BASIC

'Twas the night before Christmas. Throughout my computer room,
Not a creature was stirring — (That line you'd assume.)
The CRTs sat in a state of despair —
Just hoping St. Basic soon would be there.
The teletypes slept — computers in bed
While visions of "Do-Loops" danced through their heads.

Me in my P.J.s, my wife in her gown
Were rather upset 'cause the system was down.
When way down the hall there arose such a clatter
I sprang from my bed to see what was the matter.

In one nano-second (well . . . maybe 'twas two)
I was back to my hardware, my prized CPU.
The moon on the screen of my new CRT
Reflected so bright, like day I could see!
When what to my wondering eyes did appear,
But a *huge* floppy disc and a man growing near!

"Flying carpet from East," I murmured and cried;
But no, Saint Basic himself had arrived.
The huge disc was powered by micro's in a train,
And he whistled and shouted and called them by name:

Now Imsai, now Apple, now Intel and MITS!
On Heathkit, on Kim, (and of course) Tektronix!
From the big IBMs to the hobbyist's SOL
Now dash away, dash away, dash away all!!!

As human beings that, when hit with current, fly
When putting fingers in outlets, mount to the sky,
So down to my room, that company flew
With some software and hardware (and Saint Basic, too).

And then in a twinkling I heard on the floor
The squeak of his shoes as he opened the door.
As I drew in my head and turned it aside,
My computerist's room he walked right inside.

He was dressed all in jeans from his head to his toes
(Where he got all that denim, nobody knows).
Machine on machine he had stuffed in a sack
And he looked like a peddler opening his pack.

He was rather small — a runt, if you please,
But his eyes were lit up like big LEDs.
His hair was unkempt, but I didn't mind that,
I just sat there drooling at that big hardware sack.
His face was quite thin — like the rest of his bod
And pardon the word, but he looked like a clod!

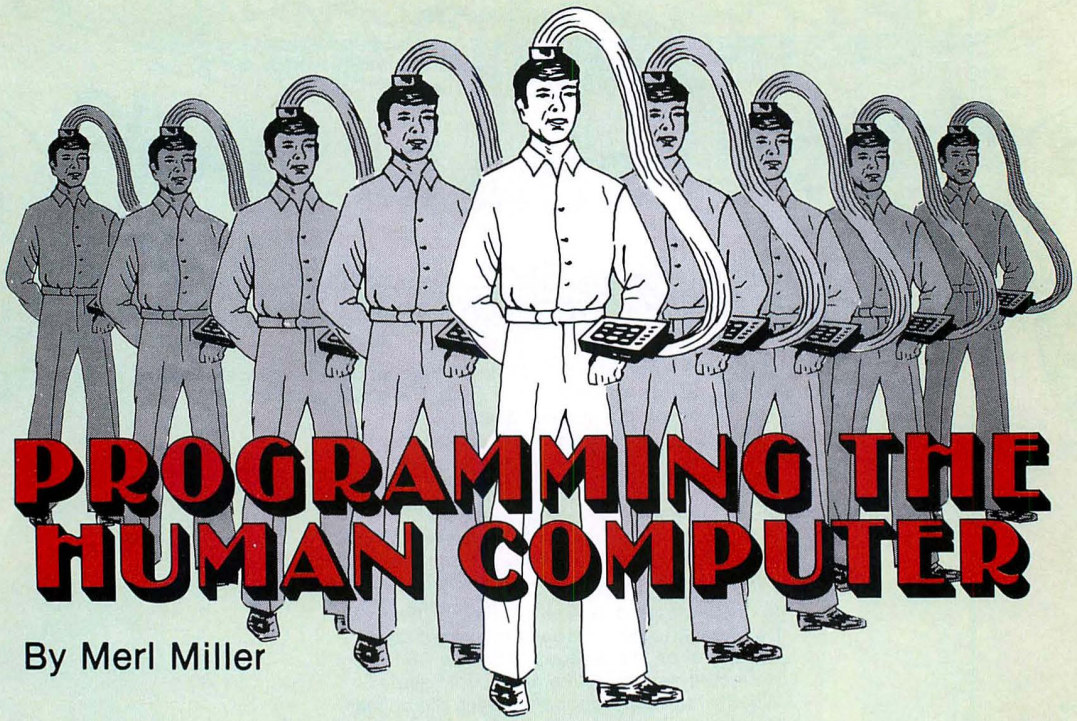
A listing of length he had stuffed in his pocket.
I'm not very sure, but I think 'twas called ROCKET.
A program tape he held tight in his teeth
And it wrapped 'round his head like an Arabian Sheik.

He looked rather tired and needed a shave,
But all of these faults I quickly forgave.
A wink of his eye — A twist of his head
Convinced me right off I had nothing to dread.

He spoke not a word but went straight to his work.
Fixed all my equipment then turned with a jerk.
And closing the lid of his tool chest behumped
He picked up his sack — out the window he jumped.

He hopped on his disc — then input one line:
For Q equals one to a hundred and nine.
Flashed a huge CRT with a mighty big byte:
"Merry Christmas to all, and to all a good night!!!"

By Jon Gauger



PROGRAMMING THE HUMAN COMPUTER

By Merl Miller

This month: Something Special for Christmas

This month, I would like to start by restating the purpose of this column and asking for your help. The purpose of this column is to help you do what you do better. If the subject is one I know something about (such as book or article writing), I'll give you my opinion; if it's something I don't know anything about, I'll either research the topic or give you someone else's opinion. This is where you come in. What would you like to do better? Let's try an example. Suppose you spend $300.00 to attend a computer convention. You fill out the registration form and you get a booklet that explains what sessions are available and who the exhibitors are. Now what do you do? Where do you go first and why? What do you do when you get there? This is the topic of next month's column. Are there other areas you would like to see explored?

It will probably be at least a year before we talk about writing again. This means we won't be discussing word use for some time, so I thought we might do something special for Christmas.

It was the nocturnal division of the dinural period preceding the feast of the Nativity, and throughout our abode, kinetic activity was not in evidence among the possessors of this potential, not even a Mus musculus.

Hosiery was suspended from the wood burning carbonic device with careful attention to detail, pursuant to our expected pleasure resulting from a visit from an eccentric philanthropist known as St. Nick.

The offspring were comfortably arranged in their respective accommodations of repose while imaginative contemplations of RAM's and ROM's moved lightly in rhythm through their craniums. My spouse and I, attired in our nocturnal headwear, had just prepared for a slumberous condition, and were actually ensconced in our accommodations of repose when out on the exterior grass covered portion of the estate there arose such a tumult that, in a totally elastic manner, I departed my position of respose to ascertain what order of undifferentiated substance of reality was occurring.

Hastening to the casement, I forthwith opened the barrier sealing the fenestration, noting thereupon that the lunar brilliance reflecting on the crystalline precipitation simulated the solar meridian. This caused my incredulous optical sensory organs to behold a miniature airborne runnered conveyance drawn by eight diminutive specimens of the genus Rangifer, being controlled by an aged chauffeur so ebullient and nimble that it became immediately apparent to me that he was indeed our anticipated caller.

With his ungulate motive power traveling at a greater vertiginious velocity than patriotic alor predations, he vociferated loudly, expelled breath musically and implored each creature by its name: "Now Dasher, Now Dancer, —et al." He carefully guided them to the highness of our residence's covering, through which structure I could distinguish the concatinations of each of the sum total of their 2^5 cloven pedal extremeties.

As I retracted my cranium from its erstwhile location and was performing an 180 degree pivot, our distinguished visitant achieved—with upmost celerity via a downward leap—entry by way of the smoke passage. He was clad entirely in animal pelts soiled by the ebon residue from oxidations of carboniferous fuels. His resemblance to a magazine ad salesman I attributed to the plethora of assorted playthings which he bore dorsally in a commodious cloth receptacle.

His orbs were scintillant with reflected luminosity, while his submaxillary dermal indentations gave every evidence of enjoying amiability. The capillaries of his nasal appurtenance were engorged with blood so that the appurtenance appeared to be the coloration of a sweet cherry.

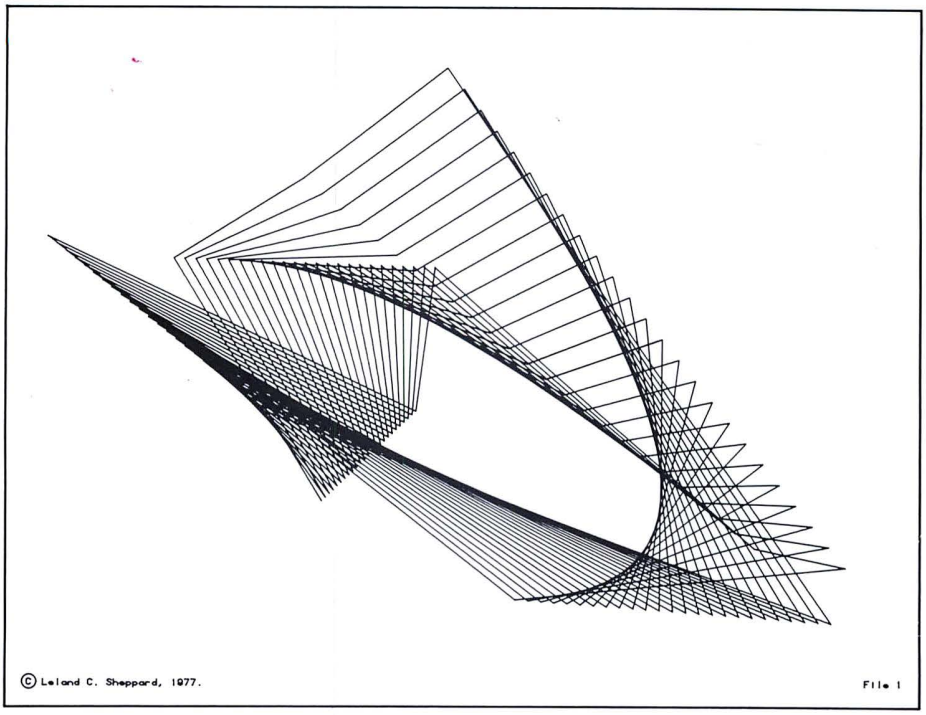
Clenched between his incisors was the posterior projection of a smoking piece whose grey fumes, forming a tenuous ellipse about his occiput were suggestive of a decorative seasonal circlet of holly. His visage was wider than it was high, and when he waxed audibly mirthful, his corpulent abdominal region undulated in the manner of gelatin.

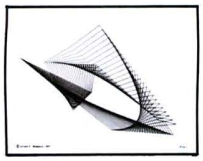
Without utterance, but with noticeable dispatch, he commenced filling the afore-mentioned appended hosiery with various RAM's, ROM's, MPU's, and various other electronic delights. Upon completion of his

Branched to page 47

Art-by-Computer$_{tm}$ - an unusual holiday gift idea

File 1





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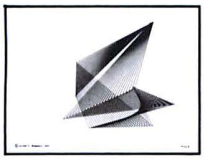

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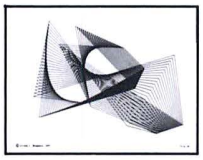

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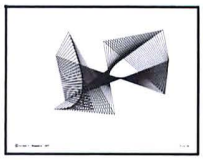

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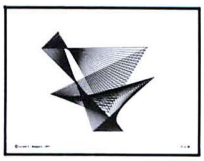

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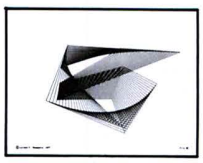

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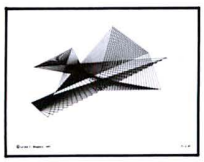

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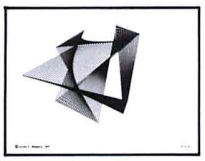

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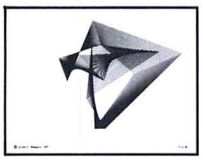

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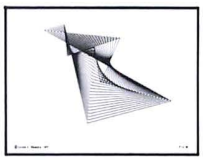

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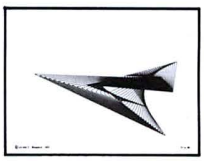

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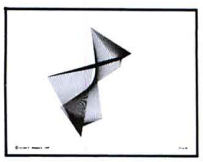
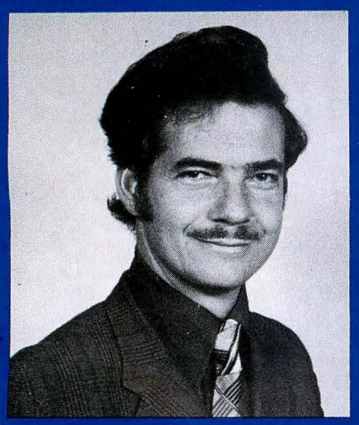


File 61

Reproductions of graphic designs generated on a Tektronix 4051 Graphics Computer/4662 Digital Plotter these black-on-white prints are 9 3/4H by 12 3/4W and are suitable for framing or mounting. Price: $2.00 ea./$20.00 for the set of 12, postage paid. Specify File #s or Set #1. Send check or money order to: Leland C. Sheppard, Dept I, PO Box 60051, Sunnyvale, California 94086. California residents add 6% sales tax. Allow 2 weeks for personal checks to clear.

. . . FROM THE FOUNTAINHEAD

By Adam Osborne



I recently returned from a trip through Europe. While there, I visited a couple of computer stores to see how the computer hobby industry is doing in Europe. I visited two stores: Microcomputer Systems, operated by Dr. E. Albarda outside of the Hague in the Netherlands, and The Computer Boutique, operated by Andrew Siligman in Paris, France. Dr. Albarda in the Hague really has a small business systems store; he does not operate a computer store in the U.S.A. fashion. His customers are entirely small businesses buying computer systems for their internal data processing. Andrew Siligman's Computer Boutique in Paris is still too new to have developed a pattern, but for the moment it looks more like a typical U.S.A. computer store. An interesting venture for Andrew Siligman is that he will have Christmas displays at Le Printemps and the Galerie Lafayette, the two largest department stores in Paris. These displays will show computer systems for small businesses and hobbyists. So far as I know, this is a first in the world — computer systems being displayed in department stores as Christmas presents.

The European computer hobby industry, and European computer stores in general, are probably twelve to eighteen months behind the U.S.A. I doubt if there are more than ten computer stores in all of Europe at the present time. The principal reason for this is a question of customer understanding. True, the economics of computer stores in Europe are not quite as favorable as they are in the U.S.A., but I do not believe this to be a major factor. There are as yet very few European manufacturers of hobby products, and the U.S. manufactured products all cost approximately 25% more in Europe. With the exception of Britain, however, salaries in Northern Europe are quite comparable to U.S.A. salaries; in Scandinavia and Germany average salaries are probably a little bit higher than they are in the U.S.A. Thus, the cost of a computer system in itself is no more of a deterrant in Europe than it is in the U.S.A. Once European customers discover what is available, I believe the market will be just as vigorous as it is over here. My conclusion is that there is an enormous opportunity in Europe for experienced U.S.A. store operators to do it again over there.

The controversy of tested and untested parts rolls on. G. Lewis Roberts in his letter (which was printed in the October issue of INTERFACE AGE) pretty much corrobates the conclusions to which I have come. There are a few good manufacturers of hobby equipment and there are plenty of bad ones. We too have received a number of favorable comments regarding SD Sales, as I mentioned last month.

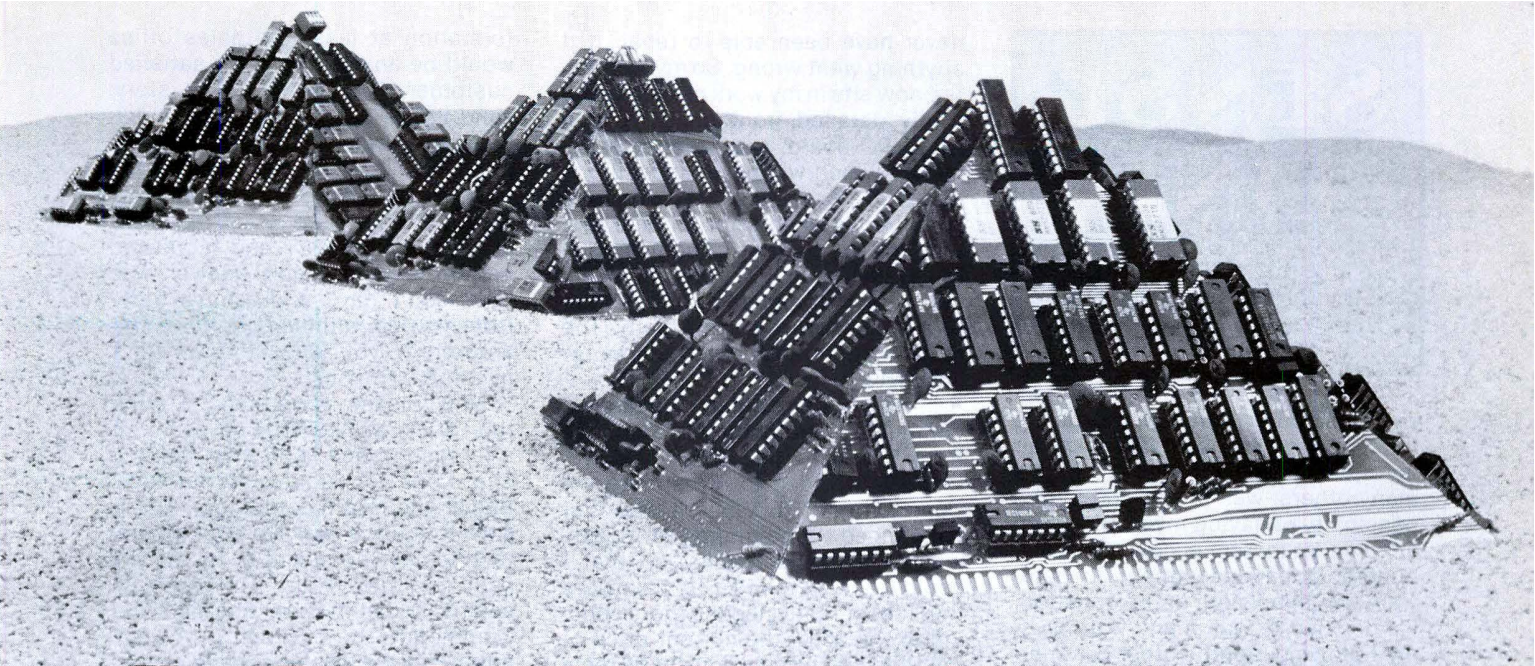
(Regarding the title of my column. Lewis, if you go back to the first issue you will see that I do not claim to be "The Fountainhead," rather, I am writing "From the Fountainhead" — the area around San Francisco where so much of the hobby industry is headquartered.)

Bill Regan, president of Technico, wrote giving the cost of rigorously testing parts. Bill says that Technico tests all their products to accepted industry standards, and this adds approximately $5.00 to the cost of an assembled microcomputer. For $20.00, Technico will take an unassembled kit and run it through their automatic tester for you. If you have an untested kit and you live near Technico, I seriously urge you to take advantage of Bill's service. The Technico telephone number in Maryland is (301) 461-2200.

In the next few months I would like to describe some end-user applications, based on microcomputer systems, which are available on a turn-key basis. I am interested in business accounting systems, instrumentation systems, or anything else you may have put together. I receive many inquiries from potential customers for such systems, but surprisingly few telephone calls from people who have products for sale. I believe there is an excellent market developing for this kind of turn-key system.

For those of you who have already developed an end-user application which you think is salable, please send me information. If it looks good I will describe it in my column, allowing computer stores and customers to contact you directly.

If you do not have an end-user application but have your own microcomputer system, let me urge you to put something together. There is a good chance that what you put together will never sell and wil be a financial failure; but there is a small chance that it will do very well. For the next year or two, the market is absolutely ready for end-user applications built around microcomputer systems; so all of you hobbyists out there get to work. My telephone number is (415) 548-2805.



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Assembling a kit can be fun; almost anyone can do it.

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We do. It's our business. We have the 200 MHz oscilloscopes, the logic analyzers, the burn-in chambers, and the test programs. We find the bugs, even the subtle ones.

Which lets you concentrate on computing.

DYNABYTE

Builders of Great Memories

SENSE LINE

By Roger C. Garrett
Founder of the Rhode Island Computer Hobbyist Club

Several years ago when the hobbyist computer industry was in its infancy and the now-famous Altair had just been introduced, I, like many others, was fascinated by the possibility of having my own system at home. At that time, however, a six-hundred-dollar investment in hardware was simply out of the question.

I decided to watch and wait. Over the following months other commercial systems appeared on the market; some with expanded capabilities, others with only the barest of boards. My interests, however, had grown tremendously and I was seriously considering the purchase of a system. Price was still a factor, and none of the systems had exactly what I wanted. An associate of mine with an equally keen interest in microprocessors suggested I build my own, not from a kit but from scratch. Well, this was a bit out of my line, for I am a software systems analyst not a design engineer. Since my friend is a design engineer, we decided to combine efforts and build our own.

I drew up a set of specifications of what I wanted the computer to do, including a fancy front panel that strongly resembled a DEC PDP-12.

While I built the front panel (25 rocker switches, 1 toggle switch, 7 momentary push buttons, and 30 LEDs) and wrote a cross-assembler in Fortran for the MCS-6502, the CPU of our system, my friend designed the logic of the system. When that was finally completed we began the task of acquiring the required parts and tools, chips, wiring, sockets, LEDs, wire-wrap tools, PC boards, and so on. The estimated final cost would be about $200, not much higher than our original estimate and quite a savings over the commercial system.

Unfortunately, during the year and a half that we worked on our home-brew system the entire computer industry was overtaking us. Our setup would be obsolete before it was finished. The S-100 bus had become a standard and we had not allowed for it. With my own limited knowledge of electronics, even if we had ever gotten it running, I would never have been able to repair it if anything went wrong. So my 'computer' now sits in my work room; a beautifully detailed front panel, a half-wired PC board, and a set of schematics which will never know life.

But all is not lost. My own personal requirements for a home system, the capabilities of commercially available units, my financial status, and commercial prices have finally met on the same path. The ready-made affordable computer has arrived.

I now have three major 'appliance' computer manufacturers to choose from. Based on their advertising brochures I decided to investigate the Commodore PET. When it was first announced I wrote them a letter asking for a user's manual so that I could evaluate the PET to make sure that it best fit my needs before sending in the $600, the current price of the PET. I received a courteous reply stating that the manual would not be available until hardware deliveries began in September. That sounded reasonable. I am well aware of the problems in producing a technical manual.

When I saw a sales representative at the National Computer Conference in June I got the same response: "September delivery." Come September I wrote another letter asking if I could buy the user's manual. The response this time was "It should be available in December." September delivery of the hardware but December delivery of the manual that tells you how to use it! That sounded rather strange to me. I wondered how those customers who had already received their units could possibly be using them to their fullest potential, or any potential for that matter, without some kind of instructions.

Next I attended the Personal Computer Exposition in New York City as a representative of INTERFACE AGE. Again I tried to get some written specifications about the PET other than the two-page sales brochure. I was told that a 'preliminary' user's manual was being produced but that I couldn't get one. I would have to buy the computer to get the manual. They would not sell the manual separately. When I asked how a potential customer could evaluate with accuracy whether the PET would meet his requirements, I was told ". . . by buying it." Send in your $600 and three months later (delivery 90 to 120 days) you can decide whether you spent your money wisely.

Obviously I wasn't getting anywhere. A few days later I called Commodore and spoke to someone in the sales department. I figured that if the people manning the demonstration booths at the computer shows didn't want to give out too much information at least the sales office would be anxious to get a satisfied customer. It was the same story: send in the cash. I began to understand the frustration of a friend of mind who worked at Brown University in Rhode Island. He, too, had contacted Commodore when they first announced the PET and requested certain details. Their answer was "We don't have a purchase order from you so, although we have the answers to your questions we can't give them to you."

Now please understand, I think the PET is a great little computer at a fantastic price and I may just purchase one yet. Along with the Radio Shack and Heath computers, PET is sure to mark a new era in computer technology, comparable to the impact of the Altair. The problem seems to be that no one has told Commodore how to sell it. A computer is not a washing machine or a stereo. It is an *intelligence* device and as such it uses and capabilities are far reaching and diverse. The potential customer will want to know exactly what to expect for his money. Can he plug in his voice output unit? If not, how can he interface to the S-100 bus? Can he set it up as a multiprocessing system? Can he plug in his own keyboard or TV set? How does he write and load machine language programs? What are the BASIC commands it recognizes?

If I am going to buy a PET, or any computer for that matter, I want to know what I am getting. It should not be too much to ask that the manufacturer supply the answers in a manual or comprehensive brochure. They can charge for the manual; that makes sense, but give us the answers. Let us evaluate before spending what for most of us is a substantial amount of money.

Now, I don't mean for this to deter anyone from buying a PET or other hardware. What I am saying is that rightly we should expect full information about products and easy access to that information — not by individual answers over the phone — so that we hobbyists may make intelligent purchasing decisions.

Let me say, finally, that so far I have only attempted to get information from Commodore. I do not know what the sales policy is at the other major 'appliance' computer manufacturers. I offer this observation to them, however; hobbyists and personal computer users, like their computers, are hungry for information. They will evaluate accurately a product *before* buying it. Satisfy the customer before the sale and he will remain happy after.

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All you need, besides the Kit, is some initiative, and a few basic tools—a good soldering iron, wire cutters, needle-nose pliers, and one or two trusty screwdrivers. The Dumb Terminal Kit provides you with everything else. Including an attractive cabinet, CRT screen, keyboard, PC board, and all essential electronic components. Naturally, you also get illustrated, step-by-step assembly instructions, not to mention an easy-to-understand operator's manual.

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CIRCLE INQUIRY NO. 81

Editorial

Home, Mother and the Microcomputer

By Linda Folkard-Stengel, Feature Editor

The microprocessor like the laser of two decades' yore, is a technology in search of applications. This is doubly true in the case of the device within the home. Indeed the microcomputer's growth as a personal toy has been phenomenal; still it remains an intruder, often considered an eyesore to the decor or a tolerated strain on the budget, a curmudgeon resented by wives and children who often feel that is competes with them for father's all-too-scarce company.

It does not need to be this way. The computer is an amiable leprechaun, willing and able to be "adopted" into the family. It can perform useful services for the home in return for the space it occupies, the installment payments it occasioned and the power it consumes. How? By becoming the electronic steward of the household.

First one must define a household. It is any dwelling of permanent residence from a one-room rural hut or urban "pad" to a mansion or palace. A household may be composed of from one person to an extended family, their servants and livestock. However, in this context we may limit our definition to a family composed of mother, father and their children. We may also define their dwelling as a single-family detached house. This image of course is misleading for it comprizes only six percent of the census-tabulated households in North America. The popular image of this dwelling is a house resplendent with the amenities of the Space Age.

In fact the opposite is true. The domestic dwelling has remained virtually unchanged for seven millenia. When Sir Leonard Woolley excavated Ur of the Chaldees, he uncovered floorplans of private homes which he describes as "modern" by 20th-Century standards.

We could reverse that point of view to conclude that our domestic architecture is so antiquated, as to be ante-diluvian.

Our room arrangements differ little from the Sumerians: a suite of kitchen, dining room, storerooms, bedrooms, nurseries, bathrooms and workrooms all connected by indoor corridors or outdoor walkways. In each room are furnishings placed along walls or grouped in the center. Then as now some rooms were sparsely furnished, and some cluttered.

The introduction of domestic plumbing is ancient. Knossos had hot and cold running water. This amenity remains the baseline of good housing to this day. What about the products and services of energy utilities? Conduits are integral with the building, but few appliances are planned and built into the house. As appliances are purchased, room is found for them. Most homes, even ten-year-old ones, lack the number of power outlets needed to accommodate the family's collection of appliances. This is a hazardous situation often leading to tragic consequences.

Even when we discount the worst cases of hazardous construction, we often find the family forced to live around the furnishings. "Buy fewer of those gadgets," some say. That is not the solution. Why strip the house of its automatic laundry, its microwave cooker, its multiple television sets and its useful bench and desk tools? They save time and alleviate us from the ugliest drudgeries. Rather we should design the house around these furnishings to integrate them into the whole structure, thereby saving space and consuming the least amount of energy.

The gross sum of kilowatts and thermal units consumed by private households is not a "bucket from the ocean." Because of its haphazard growth and development, the household is very wasteful. Thermal loss is a measurable factor. Waste includes overdesign of certain motors and systems designed to operate at constant peak load. On a national scale a vast inventory of funds and energy is tied up in the ownership and storage of expensive equipment used only periodically. In the past few years this situation is being recognized by the public who make increasing use of equipment rentals.

With the appalling rise in energy costs, private wastefulness characteristic of the Fifties and Sixties is not likely to recur. Present power bills teach a lesson of frugality for all but the very rich.

At this time frugality in the home must primarily mean self-denial because the domestic sector has been ignored as a beneficiary of the invention bonanza. That sounds like a contradiction since the popular marketing target is the family. Take a closer look to find that most of what is offered the family is technologically fifth-generation vintage. A technological *breakthrough* is an appliance such as a box with a piston which converts 100 pounds of garbage into 100 pounds of garbage.

One reason for this state of affairs might be because so few women are involved in technical design. The relatively few women engineers not engaged in aerospace work are either in life sciences or teaching. This has left the decision of domestic design in the hands of males who in turn are directed in their projects by other males from management. This last group is notorious for spending the least time at home.

The industries involved in supplying goods and service to the private life sector strive for convenience and simplicity in operation as well as the shortest mean time between failure. Advertising campaigns stress "convenience" and convert MTBF into "fashion." In their image anything operated by mother must have turnkey capability only. Being exposed to no opposing view, she too believes this — most of the time. But that wall of dogma is crumbling. Courses in auto repair are well attended by the homemaker group and the sale of hand calculators has intensified the veracity in weights and prices.

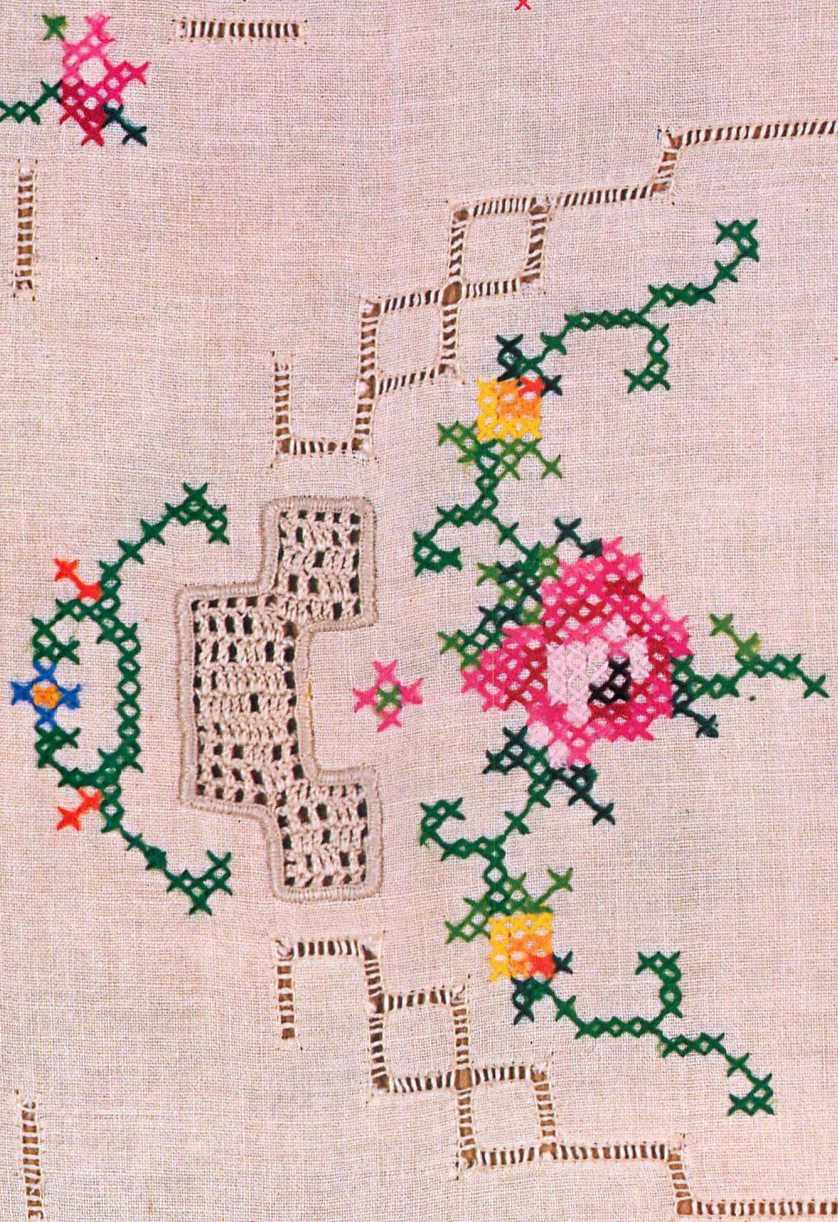
As the microcomputer gains its place as another home appliance, its use by the homemaker will increase, especially when the devices change role from additional dustcatchers to useful tools.

Earlier I spoke of the micro system as an electronic steward in the household. What can be foreseen as its functions in this role? First it can help in meal preparation. Then it can monitor thermal needs for each room in actual occupation. It can meter water use for peak and low periods of the day; direct gardening requirements of fertilizers and irrigation and calculate growth schedules of plants. The microprocessor can control security devices such as burglar alarms, electrified fences and custom radio signalled door openers. When the home is unoccupied, a program can direct lighting patterns to simulate occupancy. Coupled with vibration sensors the microprocessor could be used to turn off the gas in case of earthquake, accidental ramming or windstorms. Gas-caused fires are frequent secondary damage after these events, often causing more devastation than the original trauma.

There is a rich potential for design of the microprocessor into home applicaitons. The most qualified group to undertake this task would seem to be the woman already employed in technical endeavors. Her familiarity with the home as a system permits her to envision problems. Since more of her private life is spend in time-wasting errands than other members of the family, it is in her interest to upgrade the management objectives of the household. The technical woman might be better qualified to envision the design interface between the world of sliderules and the world of cookbooks resulting in a crop of hardware, software and firmware intelligible to the public.

The family should not be denied the comforts that the Space Age can offer. However, if the home is to survive as a nest for the traditional family, it must integrate technology, not avoid it.

The Computer As A



Things Your Husband Never Told You About Microcomputers

By Dian Crayne

Household Appliance

Unless you're one of the increasing number of women in the data processing field you probably don't know much about computers. You know that they are large, that big corporations use them for inventory control and payroll processing, and you know that once in a while they foul up your gas bill.

Now your husband has brought home something a little larger than a typewriter and introduced it as his new computer. What do you do?

Forget about the fire ax or the divorce settlement for a moment. The chances are that you can get just as much use out of that gadget as your spouse, and have just as much fun doing it. Yes, some computers are large, and corporations use them for a multitude of purposes. True, they are often blamed for oddities in the normal flow of business. Usually, however, they work correctly. And they can work for small companies as well as large ones — companies the size of your family.

That new computer can help balance the budget, convert your favorite recipe into metric, and maintain a laundry or grocery list. It can calculate how many hours the roast has to stay in the oven, and entertain you when there's nothing on television.

Your new home computer has as much power and ability as some of the commercial computers of fifteen years ago. It is a tool, and a tool which can be both valuable and rewarding to use. The main advantages of a computer are that it can process information very rapidly, and it can do the same thing over and over thousands of times without getting bored or making mistakes. A computer isn't smart, as humans think of intelligence, it just has a very good memory.

What do you have to know to use a computer? Not much more than you need to know to operate an adding machine. Forget about the circuit boards, the integrated circuits, and how many bits there are in a byte. Unless you really want to get down to the nuts and bolts of working with the equipment, all you really have to learn is how to communicate with the machine.

Computers, like people, speak different languages. Most of the smaller computers on the market today use a programming language called BASIC. This, like the other programming languages, is just a set of instructions or commands that the computer is built to understand. A series of these instructions is called a program. A computer program can make the machine accept information and store it, add numbers together, subtract, multiply and divide. It can also instruct the computer to display information and to process it in a special order.

Although programming looks baffling at first glance there is no particular mystery about it. Let's take a look at this little example, which calculates the cooking time for a pot roast.

```
10 LET A = 0
20 LET B = 0
30 LET C = 0
40 PRINT "HOW MANY WHOLE POUNDS DOES IT WEIGH?"
50 INPUT A
60 A = A * 16
70 PRINT "AND HOW MANY OUNCES?"
80 INPUT B
90 X = A + B
100 PRINT "WELL-DONE (1), MEDIUM (2), OR RARE (3)?"
110 INPUT C
120 IF C = 1 GOTO 160
130 IF C = 2 GOTO 180
140 Y = X * 1.25
150 GOTO 190
160 Y = X * 1.87
170 GOTO 190
180 Y = X * 1.56
190 Y = Y/60
200 PRINT "COOK IT FOR";Y;"HOURS."
210 END
```

First, notice the numbers on the left side. These are line numbers. A program usually starts at line number 10 with each additional line number increased by ten. This way you can put in extra lines later, if you need to. Line numbers are necessary because they provide a map for the machine. Without the numbers the computer would lose its place in the program.

The first three lines of our program are for what is called "initialization." This means that you have set the values to something (zero in this case) to be sure that your later calculations will be correct. Initialization is not always necessary, but it never hurts and can be very valuable.

On Line 40 there is a PRINT statement. This directs the computer to display the line that is in quotation marks. The INPUT line following it tells the program to wait for a number from the person talking to it.

Probably the most common programs running on home computers today are game programs. Chances are that the man in your life has one running on his computer right now. Game programs are popular with the hobbyist for two main reasons. First, they are relatively easy to program and fun to play. Second, not many people have really worked on the other things the home computer can do.

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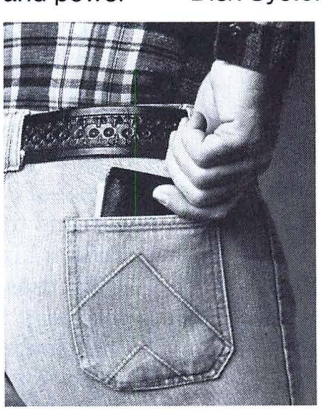

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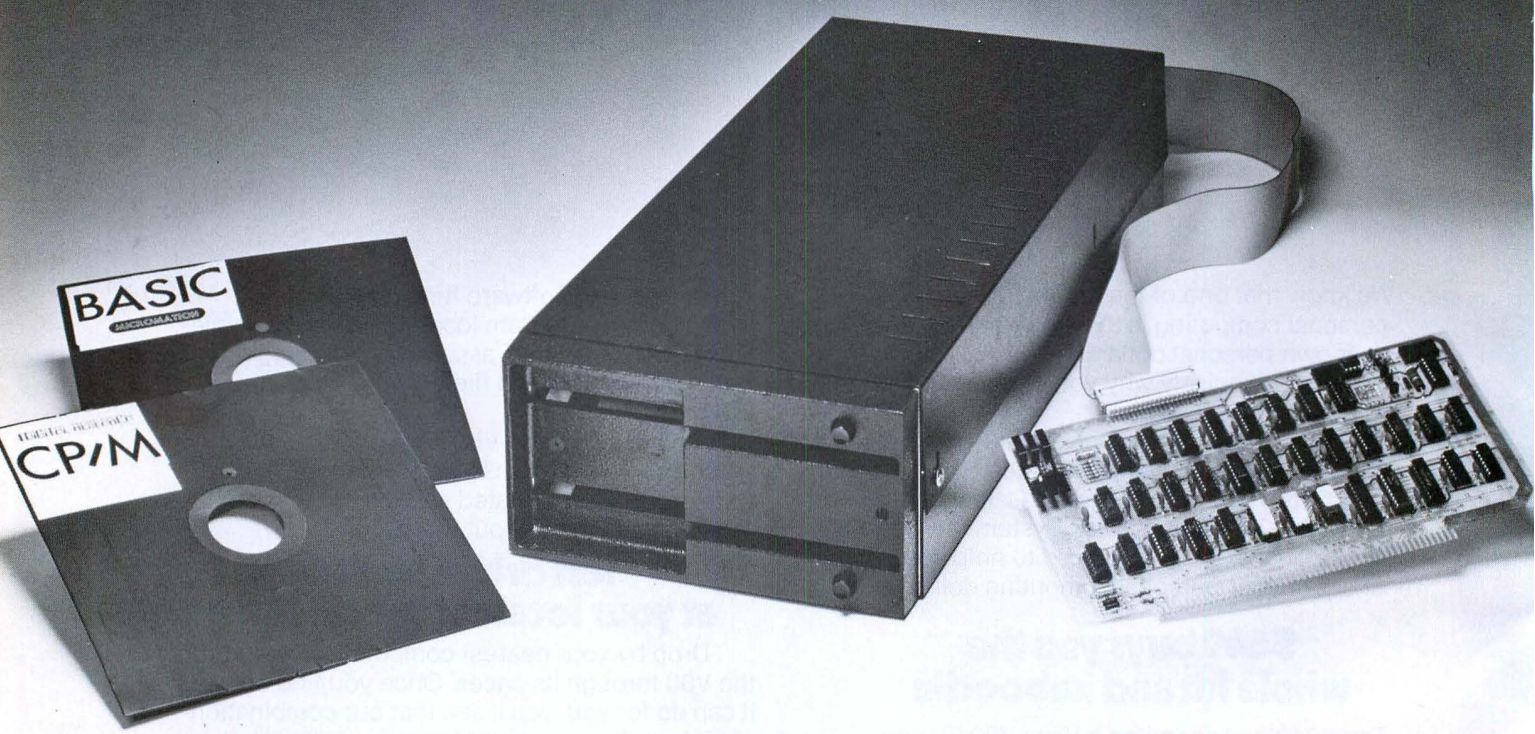

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On Line 60 the program is instructing the computer to take the number which was entered, represented by A, and multiply it by 16. This multiplication provides the number of ounces in the poundage entered. (A, incidentally, is what is called a variable. It is a number whose value can change each time the program is used or "run.")

Lines 70, 80, and 90 of the program ask for the number of ounces of weight, and then add that number to A. This addition gives the total weight of the roast. The program has been written so that the result is called X. X is the result of adding A and B.

The next section, Lines 100 through 190, takes care of the actual cooking time. Since there are three possibilities (Well, Medium, and Rare) the lines have to be separated by GOTO statements. Otherwise the numbers would be multiplied all three times and you would have a *very* well done piece of meat. The program causes the computer to check a selection against the possibilities given on Lines 120 and 130. If the selection isn't equal to either 1 or 2 the computer does the calculation on Line 140 and gives us the cooking time for a rare roast. The numbers are 1.25, 1.87, and 1.56, which represent minutes per ounce, are "constants." Unlike variables they will be the same each time the program is run.

Line 150 bypasses the other multiplication and sends the machine to Line 190 where it divides the total minutes of cooking time by 60 to get the number of hours. The answer is printed out on Line 200.

The last line in the program is an END statement. Each program must have an END so the computer will stop processing.

Four of the lines in our program contain GOTO statements. This instruction means exactly what it says. It tells the machine to GO TO a particular line number. Another similar statement in BASIC is GOSUB. This instruction, not shown in our example, tells the computer to go to a particular line, do that series of instructions, and then come back to where it was. GOTO and GOSUB are two of the most common statements used in BASIC programs.

When this program is actually run it looks like this:

```
HOW MANY WHOLE POUNDS DOES IT WEIGH?
6
AND HOW MANY OUNCES?
7
WELL-DONE (1), MEDIUM (2), OR RARE (3)?
2
COOK IT FOR 2.67 HOURS.
```

As you can see, the answer is in hours and fractions of hours. There was no calculation in the program for changing the answer into hours and minutes. (An interesting addition to the program would be to ask for the time the roast should be served and then calculate the time it ought to go into the oven. This would involve subtracting time, and might lead to questions of using 24 hour or "military" time.)

Although many programs are quite complicated, others are just as straightforward as our example. With a little practice you can write simple, useful BASIC programs. Get to know your machine's version of BASIC. There is probably a small manual that came with the computer. If there isn't one, get your spouse to write down the instructions for you and how they have to be entered. (Machines are picky about punctuation. Some like apostrophes, others insist on quotation marks, etc.) Enter a few sample programs copied from books or magazines to get an understanding of how the instructions are used. Then write a simple program of your own. It can be as easy as the example just shown. The more you work with your new tool the better you will understand it. Computer programming can be interesting, creative, and it can also be useful. Why should your husband have all the fun?

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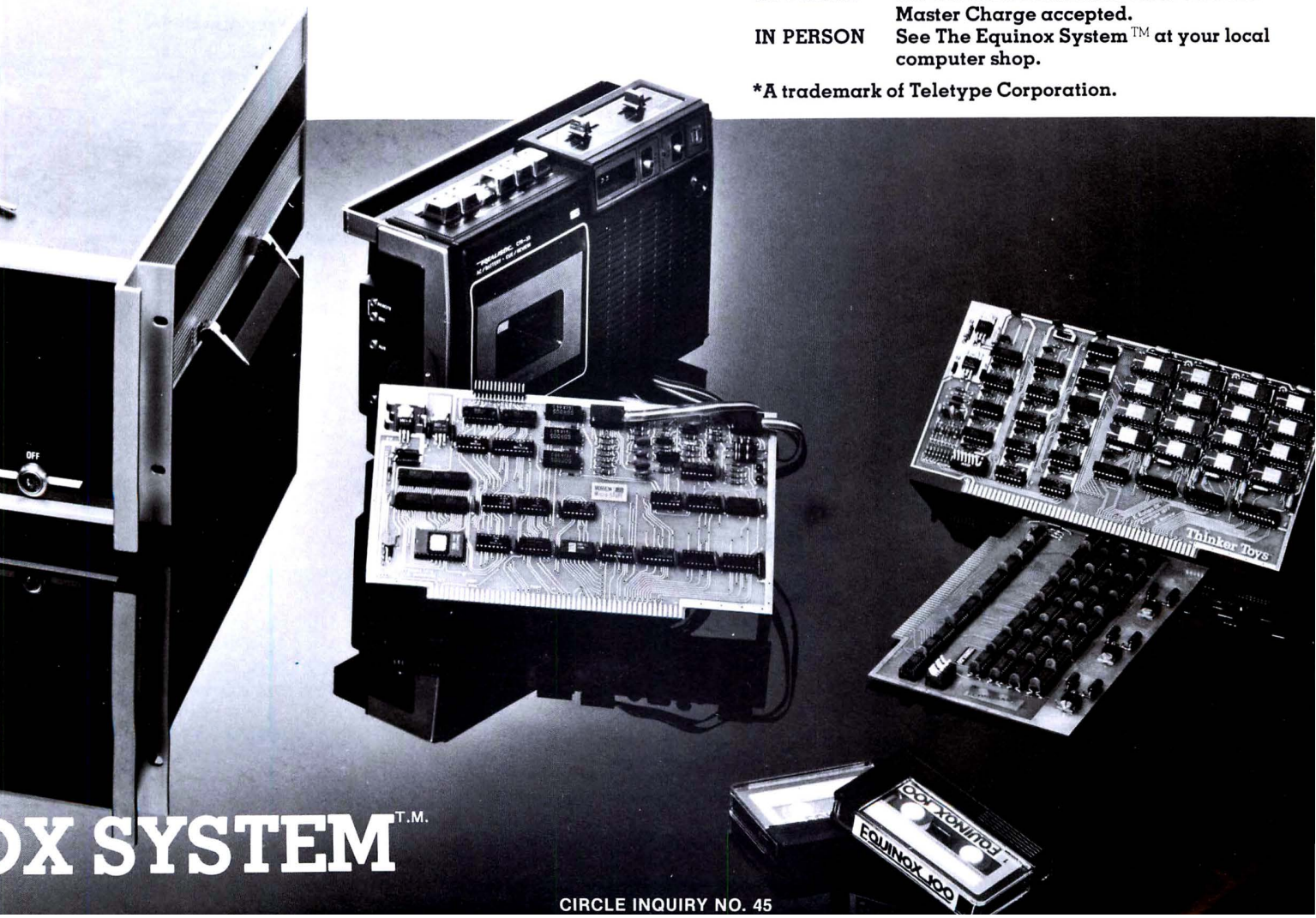

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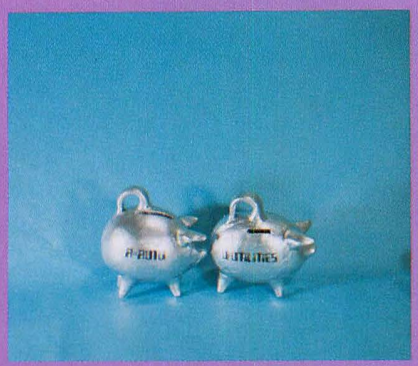
Household Finance System I

By Francis Ascolillo

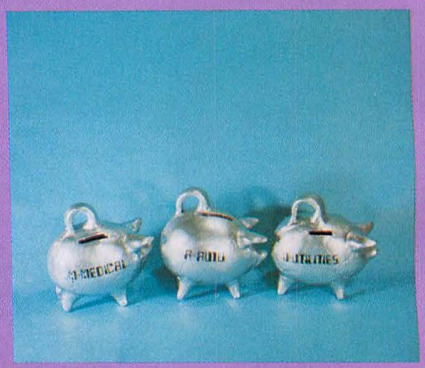
INTRODUCTION

The Household Finance System (HFS) is a two-part program designed to give the average family a rapid concise overview of its economic tendencies and trends. The theme is centered around the family checkbook and can be run by the person who balances the checkbook, whether that person is computer-oriented or not. This can be a great way to show your wife the usefulness of the home computer system, especially if she normally keeps track of the checkbook.



This first part, HFS I, utilizes a FORTRAN-like formatted input configuration to provide MONTHLY REPORTS consisting of itemized and categorized printouts suitable for storage and future reference. It also makes provision for a punched paper tape containing all of the year-to-date data for use with subsequent monthly runs and is the basis for analysis provided by the companion article, HFS II.

HFS I is intended to consider twelve categories of expenses as shown on the sample run as ITEM CODES. These can be changed very simply to conform to your own personal system of categorization of expenses.



This breakout is critical and any changes should be carefully considered. The number of categories was fixed at twelve because of memory constraints and should prove adequate as long as the expenses are applied consistently to the proper item code. This categorization of a particular type of expense should be carefully preplanned and then strictly maintained.

FEATURES

This is a highly automated program utilizing a formatted input arrangement, which unlike BASIC, allows multiple, tabular entries on the same line at time of inputting. It produces a finished MONTHLY RECORD of all expenditures at least 8½"x11" in size for filing. It lists all checks by number, nature of expense, amount, reason for expenditure and totals per

The program is "human engineered" to prevent crashes and will ignore most improper entries. Errors are corrected by typing a BACK-ARROW, upon which the program will print "XX" and go to the next field without entering any data in the erroneous field or in the totals.

The program provides storage on punched tape of each month's data, for use in the next month's run, the next twelve months, last twelve months, or for other future extensions, not yet developed in the program. The tape storage feature allows the user to enter months in any order and frees the computer for other programs without loss of year-to-date data by removing the program until needed the following month.

SYSTEM REQUIREMENTS

Both HFS I and HFS II were developed to run on an Altair 8800 with 12K of memory containing 8K MITS BASIC through an ASR 33. Each section can be run individually in 12K of memory or both HFS I and HFS II can be run simultaneously in 16K of memory. The "remark" statements are removed when the tape is read in and this is necessary to remain within the listed memory constraints.

The listing for HFS I requires 3570 bytes storage without the remark statements and 5490 bytes to run on top of BASIC. *The HFS II* tape can be run in on top of this tape and both run

simultaneously simply by reading in the HFS II tape after HFS I is resident.

OPERATION

After run is typed, prompts will appear and are answered in the usual BASIC manner. Then the DEPOSIT field will appear. Each monthly deposit is then entered with a "space" bar to indicate the end of a particular entry. The present program configuration will accept up to thirty deposits. To change this number, change the "30" in line 21 to reflect the maximum number of deposits you normally encounter. Spacing and line length are automatic. After the last deposit is entered and the "$" appears, type ANY LETTER to exit this field. The program then types a TEARLINE and enters the EXPENDITURE field. This is oriented towards checks you have written and is based on the CHECK NUMBER. This program configuration will accept fifty-five checks, in addition to any voided checks. To increase or decrease this number, change "55" as found in lines 9, 36, and 936 to reflect the number of checks you usually write. The number of checks you issue in a month may surprise you. Type the proper CODE next to the proper CHECK NUMBER to indicate the type of expenditure, then the amount, SPACE BAR, a DESCRIPTION of the expenditure and end the line with a carriage return. The ITEM DESCRIPTION will accept thirty characters and should be complete enough so as to be identifiable many months later. Keep in mind: The description field is not stored in memory and is saved only on the monthly hard copy report. To change the length of the description field change the "30" in line 54 to the desired field length. No corrections are allowed in the

Description Field. The carriage return will increment the check number, and prepare the next line. Type "V" for any voided checks. When all checks are entered, type ANY NUMBER in the CODE COLUMN and the program will proceed to the TOTALS portion. Answer the prompts to obtain the readout you wish. A SECOND TEARLINE will appear.

By cutting on these tearlines, a monthly record is made to be preserved for future reference. When prompted, mount the prior MONTHLY TAPE and start the reader. When the tape is finished, the program will automatically go to the next stage. If you don't have a tape to read, just type "NO" and the program will accommodate itself to that situation. It is not necessary to enter the months in the proper chronological order, either by "tape" or the monthly run as the program will sort this out. Do not attempt to type a monthly tape on LOCAL by the keyboard, as the parity bit could make it read wrong in the program. When the program is finished, it will prompt you to turn on the tape punch. Do so, and type a carriage return. This will provide a compilation of all monthly data on one tape for future use.

This procedure allows you to maintain one tape per year and dispose of the intermediate tapes. An AUTO PAGE feature is included to insure a minimum monthly record page of 11" length between tearlines for easy filing. This can be disabled by removing line 82, but will make filing of the monthly record more difficult.

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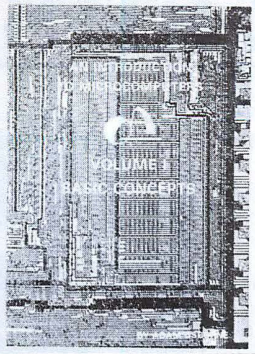

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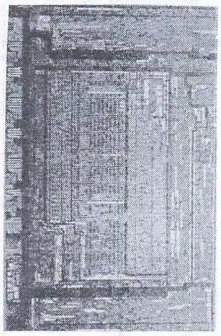
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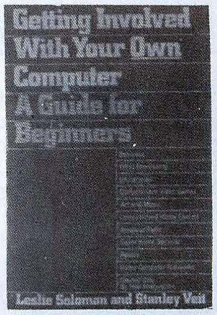

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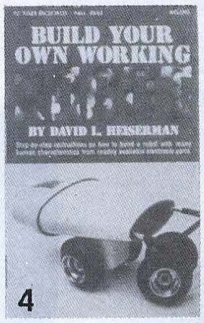

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12 TYCHON's 8080 Octal and Hex Code Cards

The code cards are a sliderule-like aid for programming and debugging 8080 software. Both cards contain all the standard mnemonics and either their corresponding octal or hex codes. The pocket size cards are 6.5 by 3 inches (16 by 8 cm) with color-coded instructions to provide a neat, logical format for quick reference. The back of both cards is printed with an ASCII code chart for all 128 characters plus the 8080's status word and register pair codes.

13 INTERFACE AGE Binders and Slip Cases

Collecting magazines can bring headaches — not to mention dust, ripped pages and misplaced copies. If you use your back issues of INTERFACE AGE as reference material, nothing is more annoying than taking time to find mislaid copies. Data Dynamics Technology is now offering deluxe binders and slip cases which will place each back issue of INTERFACE AGE at your fingertips. Each binder and slip case is constructed of a handsome blue vinyl with INTERFACE AGE stamped in gold foil on the front cover and spine. These rugged binders and slip cases can hold 12 issues each and will protect your back issues of INTERFACE AGE for years.

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Accent on BASIC. By Donald D. Spencer
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By Neil Graham. 382 pages, $8.95
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By Gerald F. Stapleton. 192 pages, $7.95
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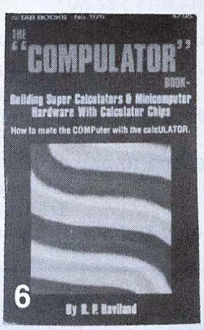

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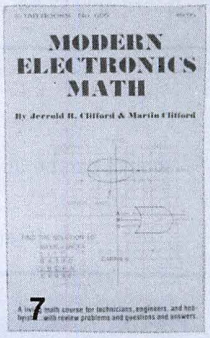

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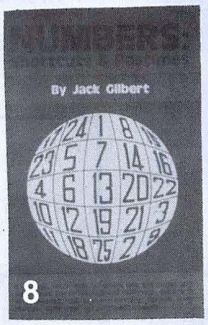

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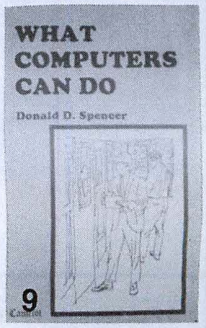

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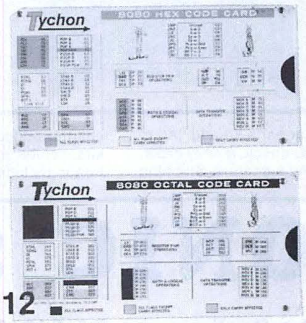

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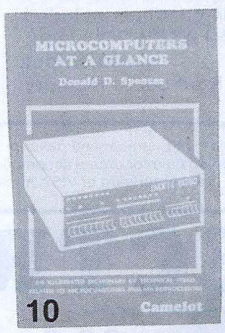

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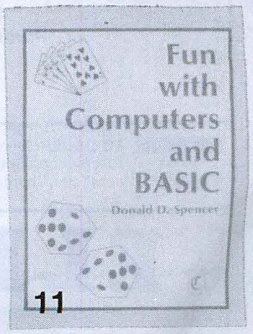

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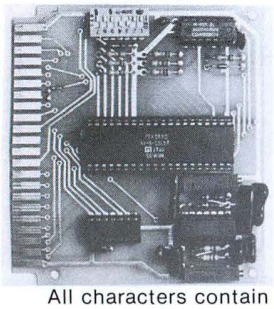
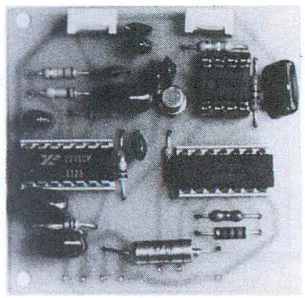
HOBBY COMPUTER KITS

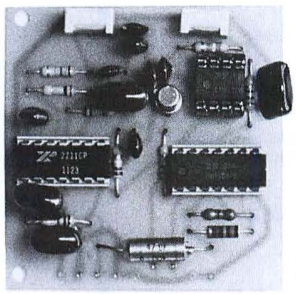


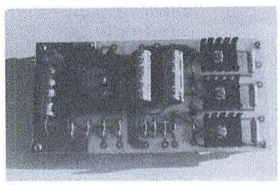
UART and BAUD RATE GENERATOR Part No. 101
Converts serial to parallel and parallel to serial
Low cost on board baud rate generator
Baud rates: 110, 150, 300, 600, 1200 and 2400
Low power drain + 5V and − 12V required
TTL compatible
All characters contain a start bit, 5 to 8 data bits, 1 or 2 stop bits, and either odd or even parity
All connections go to a 44 pin gold-plated edge connector
Board only $12.00, with parts $35.00

TAPE INTERFACE Part No. 111
Play and record Kansas City Standard tapes
Converts a low cost tape recorder to a digital recorder
Works up to 1200 baud
Digital in and out are TTL
Output of board connects to mic. in of recorder
Earphone of recorder connects to input on board
Requires + 5 volts, low power drain
No coils
Board only $7.60, with parts $27.50



MODEM Part No. 109
Type 103
Full of half duplex
Works up to 300 baud
Originate or Answer
No coils, only low cost components
TTL input and output
Connect 8 ohm speaker and crystal mic. directly to board
Uses XR FSK demodulator
Requires + 5 volts
Board only $7.60, with parts $27.50

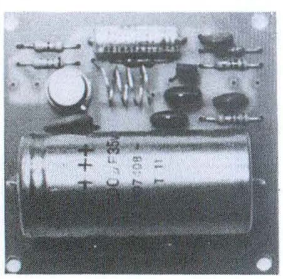




D.C. POWER SUPPLY Part No. 6085
Board supplies a regulated + 5V at 3 amps, + 12, − 12, and − 5 volts at 1 amp
Board has filters, rectifiers and regulators
Power required is 8V AC at 3 amps, and 24V AC C.T. at 1.5 amps
Board only $12.50

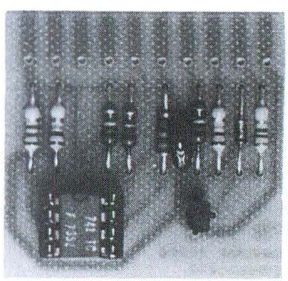
4K/8K STATIC RAM Part No. 300
8K Altair buss memory
Uses 2102 Static memory chips
2-4K Blocks
Blocks can be addressed to any of 16 4K sections
Vector input option
Tri-state buffered
Board only $22.50, with parts $160.00

TIDMA Part No. 112
Tape Interface Direct Memory Access
Record and play programs without bootstrap loader (no PROM)
Has FSK encoder/decoder for direct connections to low cost recorder at 625 baud rate, and direct connections for inputs and outputs to a digital recorder at any baud rate.
S-100 buss compatible
Comes assembled and tested for $160.00



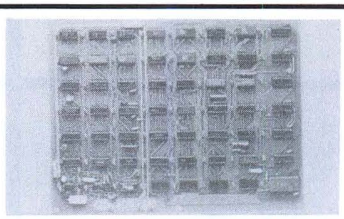
RF MODULATOR Part No. 107
Converts video to AM modulated RF, Channel 2 or 3
Power required is 12V AC C.T., or + 5V DC
Board only $4.50, with parts $13.50

RS-232/TTL INTERFACE Part No. 232
Converts TTL to RS-232, & converts RS-232 to TTL
Two separate circuits
Requires + 5 and − 12 volts
All connections go to a 10-pin gold-plated edge connector
Board only $4.50, with parts $7.00



APPLE 1 MOTHER BOARD Part No. 102
10 slots — 44-pin (.156) connectors spaced ¾" apart
Connects to edge connector of computer
Pin 20 and 22 connects to X & Z for power and ground
Board has provisions for by-pass capacitors
Board cost $15.00

TELEVISION TYPEWRITER Part No. 106
Stand alone TVT
32 char/line, 16 lines, modifications for 64 char/line included
Parallel ASCII (TTL) input
Video output
1K on-board memory



Output for computer controlled curser
Auto scroll
Non-destructive curser
Curser inputs: up, down, left, right, home, EOL, EOS
Scroll up, down
Requires + 5V at 1.5 amps, and − 12V at 30mA
Board only $39.00, with parts $145.00

VISA®

TO ORDER: Mention part number and description. For parts kit add "A" to part number. Shipping paid for orders accompanies by check, money order, or Master Charge, BankAmericard or VISA number and signature. Shipping charges added to C.O.D. orders. California residents add 6.5% for tax. Parts kits include sockets for all ICs, components, and circuit board. Documentation is included with all products. Dealer inquiries invited.

master charge

ELECTRONIC SYSTEMS

P.O. Box 212 • Burlingame, CA 94010 • (408) 374-5984

CAUTIONS

The following cautions must be noted:

- The carriage return should only be used in answering prompts and to end the "Item Description."
- A non-valid character will not echo nor enter.
- If the program is expecting a number, and a letter is entered, it will exit the field. (Also Vice-Versa)
- Some portions of the program are slow, so give them a chance to operate.
- The month must be entered numerically, such as 5, 77 instead of May, 1977.

HINTS

The most critical area of this program is the categorization of a particular expenditure and proper codification. For example, A = Automobile. Any expense connected with the acquisition, operation, or maintenance of all autos in the household should be coded "A." This includes gasoline, acquisition costs, registration fees, repairs, taxes, etc. Household should be used for rent, mortgage payments, real estate taxes, improvements and any other real estate expense as distinguished from curtains or furniture which would not be left with the house if and when it is sold. Paycheck, for example, is used to list payroll deductions such as insurance, taxes, etc. These code allocations are general and can be tailored to the individual household, but the number of code groups must be maintained at twelve.

The accuracy and successful application of this program is directly related to the frequency of using checks on as many expenditures as possible. All incoming monies should be deposited and operating cash should be obtained by cashing a check for cash.

CONCLUSION

Businesses depend on past and future financial trends and tendencies in order to maintain profit and growth in their operations. Through careful application and consideration of the data evolved by this program, the average household will be provided with economic feedback not ordinarily available. It will point out your spending habits and allow you to make rational decisions on future financial trends or planning.

HFS I provides a complete data base for use in HFS II and reference at later dates if you spot a bad financial trend developing as indicated by HFS II. If a non-computerist handles the checkbook, this will be no problem at all for her/him. The automatic features are disconcerting at first, but give the person a chance to operate and the system will provide a speedy comfortable way to develop data for immediate and long term usage.

EXAMPLE OF MONTHLY RECORD EXPENDITURES

```
RUN
WHAT MONTH (TYPE M,Y)? 5,77
STARTING CHECK NUMBER? 1246
STARTING BALANCE? 600


ENTER DEPOSITS
$125   $215.46   $27.04   $15   $215.26   $.45   $215.46   $215.4
 $87.23   $X

                        ITEM CODES

A- AUTO                          H- HOUSEHOLD
B- BUSINESS                      M- MEDICAL
C- CASH                          P- PAYCHECK
D- HOBBIES                       S- SAVINGS
E- EDUCATION                     U- UTILITIES
F- FOOD                          X- EXTRAS

ENTER EXPENDITURES

--------------------------------------------------------------------------------

                              MAY, 1977

CHECK CODE  AMOUNT          ITEM
 1246   A   $22.45         LUBE CHEVY
 1247   E   $8.55          DINNER
 1248   C   $20            5 10 WEEKEND
 1249   D   $10.95         WIRE WRAP WIRE
```

```
1250   F   $115.1        REGULAR SHOPPING
1251   H   $14.33        DEN CURTAINS
1252   H   $13.63        DEN PAINT
1253   S   $50           FIRST NAIL
1254   U   $66.01        ELECTRIC
1255   X   $10           5 GEESE
1256   U   $22.50        TELEPHONE
1257   A   $87.53        MOBIL
1258   X   $4.95         GOOSE FEED
1259   H   $245.76       MORTGAGE
1260   D   $24           TTY PAPER
1261   E   $12.55        FLUTE RENTAL
1262   B   $50           BOSTON TRIP
1263   X   $10.4         BANKAMERICARD
1264   F   $108.66       REGULAR SHOPPING
1265   C   $20           5 24 WEEKEND
1266   M   $15           DENTIST
1267   V
1268   E   $4.80         FORTRAN TEXT BOOK
1269   2


WANT ITEMIZED BREAKDOWN ? YES

$ 109.98 =AUTO
$ 58.55 =BUSINESS
$ 40     =CASH
$ 34.95 =HOBBIES
$ 17.35 =EDUCATION
$ 223.76 =FOOD
$ 273.72 =HOUSEHOLD
$ 15     =MEDICAL
$ 0      =PAYCHECK
$ 50     =SAVINGS
$ 88.51 =UTILITIES
$ 25.35 =EXTRAS

DEPOSITS THIS MONTH        $ 1116.36
EXPENDITURES               $ 937.17
UNACCOUNTED MONIES         $ 179.19
PRESENT BALANCE            $ 779.19
--------------------------------------------------------------------------------
DO YOU HAVE A TAPE TO READ ? YES

START TAPE READER

DO YOU WANT A YEARLY TOTAL ?   YES
$ 111.21 =AUTO
$ 60.78 =BUSINESS
$ 43.23 =CASH
$ 39.18 =HOBBIES
$ 22.58 =EDUCATION
$ 229.99 =FOOD
$ 280.95 =HOUSEHOLD
$ 23.23 =MEDICAL
$ 9.23  =PAYCHECK
$ 60.23 =SAVINGS
$ 99.74 =UTILITIES
$ 37.59 =EXTRAS
$ 950.4 =EXPENDITURES THIS YEAR
$ 1130.59 =DEPOSITS THIS YEAR
$ 194.42 =UNACCOUNTED MONIES   $


IS TAPE PUNCH ON? YES
                3       1.23  2.23  3.23  4.23  5.23  6.23  7.23
 8.23  9.23  10.23  11.23  12.23  13.23  14.23  15.23          5
 109.98  58.55  40  34.95  17.35  223.76  273.72  15  0  50  88.51
 25.35  937.17  1116.36  179.19          A
OK
```

PROGRAM BASIC LISTING

```
1 REM       **HOUSEHOLD FINANCE SYSTEM**
2 REM                BY FRANCIS ASCOLILLO
3 REM  TYPE IN DOLLAR AMOUNT THEN SPACE BAR
4 REM  AFTER LAST DEPOSIT IS ENTERED, TYPE ANY LETTER
5 REM  TYPE V IN THE CODE COLUMN FOR ANY VOIDED CHECKS
6 REM  AFTER LAST EXPENDITURE IS ENTERED, TYPE ANY NUMBER
7 REM  CAR/RET IS USED TO ANSWER PROMPTS AND END DESCRIPTION
8 REM  IN EXPENDITURE FIELD.  OTHERWISE, DON'T USE IT.
9 DIME(65,2),C(12,15),D(8)
10 INPUT"WHAT MONTH (TYPE M,Y)";M,Y:IFY>99THENY=Y-1900
15 INPUT"STARTING CHECK NUMBER";C
20 INPUT"STARTING BALANCE";B1:PRINT:PRINT:IFX=1THENB5=B1
21 PRINT"ENTER DEPOSITS":PRINT"$";:FORI=1TO30:GOSUB900:IFF=1THEN25
22 IFIA=95THENPRINT"XX  $";:NEXTK1
23 L=L+1:IFL=8THENL=0:PRINT:D=D+I2:PRINT" $ ";:NEXTK1:PRINT
24 D=D+I2:PRINT" $";:NEXTK1:PRINT:LN=35
25 LN=35:PRINT:PRINT:PRINTTAB(24);"ITEM CODES":PRINT
27 PRINT"A- AUTO";TAB(30);"H- HOUSEHOLD":PRINT"B- BUSINESS";TAB(30);
28 PRINT"M- MEDICAL";PRINT"C- CASH";TAB(30);"P- PAYCHECK"
29 PRINT"D- HOBBIES";TAB(30);"S- SAVINGS":PRINT"E- EDUCATION ";TAB(30);
30 PRINT"U- UTILITIES";PRINT"F- FOOD";TAB(30);"X- EXTRAS":PRINT
31 PRINT"ENTER EXPENDITURES":PRINT:GOSUB964:PRINT:PRINT:PRINTTAB(24)
32 ONKGOSUB721,722,723,724,725,726,727,728,729,730,731,732
33 PRINT",";Y+1900::PRINT:PRINT:PRINT"CHECK";TAB(6);
36 PRINT"CODE";TAB(12);"AXOUNT";TAB(27);"ITEM":E=0:FORK=1TO65
40 PRINTC;TAB(8);:C=C+1:GOSUB885:IFIA<65THEN64
44 IF IA=36 THEN PRINT:GOTO 40
46 E(K,1)=IA:PRINTTAB(12);"$";:GOSUB900
48 IFI(1)=9999THENC=C-1:PRINT"XX":GOTO40
50 E(K,2)=I2:PRINTTAB(25)
54 FORA=1TO30:%WAIT16,1:I=INP(17):I$=CHR$(I):IA=I-128
56 IFIA=13THENPRINT:GOTO62
60 PRINTI$;:NEXTA
62 LN=LN-1:NEXTK
64 FOR A=1 TO K:E=E+E(A,2):NEXT A
70 PRINT:PRINT:PRINT:INPUT"WANT ITEMIZED BREAKDOWN ";C$:PRINT
72 Q=1:IFLEFT$(Q$,1)="N"THENG=0:LN=LN+12
73 REM **END OF MONTH TOTALS
74 FORI=1TO12:READX,X$:GOSUB964:IFG=1THENGOSUB966:PRINTX$
75 NEXTI:PRINT:PRINT DEPOSITS THIS MONTH";TAB(25);"$";I
76 PRINT"EXPENDITURES";TAB(25);"$";E
77 DE=INT((D-E)*100)/100:PRINT"UNACCOUNTED MONIES";TAB(25);"$";DE
78 B=B1+DE:PRINT"PRESENT BALANCE";TAB(25);"$";B
80 C(M,13)=E:C(M,14)=D:C(M,15)=DE:PRINT:PRINT
82 IFLN=>1THENFORG=1TOLN:PRINT:NEXTG
84 GOSUB968:PRINT
88 INPUT"DO YOU HAVE A TAPE TO READ ";C$:IFLEFT$(C$,1)="N"THEN408
90 PRINT:PRINT"START TAPE READER":A5=44:A6=12:A7=15:A8=1:GOSUB 596
129 REM**PROCESS TAPE READ DECIMAL
140 PRINT:INPUT"DO YOU WANT A YEARLY TOTAL ";C$:RESTORE
142 IFLEFT$(C$,1)="N"THEN408
144 REM **PRINTS ITEM TOTALS
```

```
146 FORM=1TO15:GOSUB400:PRINTX$:NEXTM
408 PRINT:PRINT:INPUT"IS TAPE PUNCH ON";G$
409 REM **PUNCH TAPE
410 GOSUB504:GOSUB504:X=0
414 FORM=1TO12:JT=0:FORJ=1TO15:JT=JT+C(X,J):NEXTJ
415 IFJT=0THENIFX=<11THEN501
416 IFJT=0THENIFX=>12THEN502
417 PRINTX;:GOSUB506:FORJ=1TO15:P=C(X,J)
419 IFP<0THENPRINTCHR$(32);CHR$(32);
420 PRINTP;:NEXTJ:GOSUB506:FORZ=1TO4:PRINTCHR$(32);:NEXTZ
501 NEXTX
502 PRINT  "A";:GOSUB504:T1=1:GOTO1005
504 FORZ=1TO10:PRINTCHR$(32);:NEXTZ:RETURN
506 FORZ=1TO4:PRINTCHR$(32);:NEXTZ:RETURN
595 REM **READ TAPE
596 WAIT16,1:IA=INP(17)
597 IFIA=<A5THEN596
598 IFIA=>58THENRETURN
599 X=IA-48:WAIT16,1:IA=INP(17):IFIA<>32THENX=10*(IA-48)
601 FORJ=A9TOA7:V=0:V1=0
604 WAIT16,1:IA=INP(17)
605 IFIA<46THEN604
606 D7=1:IFIA=46THEN630
607 D(D7)=IA-48:WAIT16,1:IA=INP(17):IFIA=46THEN630
608 IFIA>45THEND7=D7+1:GOTO607
609 M$="":FORX=1TOD7:M$=M$+STR$(D(X)):NEXTX
610 C(X,J)=V+VAL(M$):NEXTJ:GOTO596
630 WAIT16,1:IA=INP(17):V=0:V1=0:IFIA=32THEN609
632 V1=IA-48:WAIT16,1:IA=INP(17):IFIA=32THENV=V1/10:GOTO609
636 V=(V1/10)*(IA-48)/100:GOTO609
721 PRINT"JANUARY";:RETURN
722 PRINT"FEBRUARY";:RETURN
723 PRINT"MARCH";:RETURN
724 PRINT"APRIL";:RETURN
725 PRINT"MAY";:RETURN
726 PRINT"JUNE";:RETURN
727 PRINT"JULY";:RETURN
728 PRINT"AUGUST";:RETURN
729 PRINT"SEPTEMBER";:RETURN
730 PRINT"OCTOBER";:RETURN
731 PRINT"NOVEMBER";:RETURN
732 PRINT"DECEMBER";:RETURN
750 REM **VALID INPUT
752 IFIA=32ORIA=95ORIA=46THENPRINTI$;:RETURN
754 IFIA=>48THENIFIA=<57THENPRINTI$;:RETURN
756 IFIA=>65THENIFIA=<90THENPRINTI$;:RETURN
762 WAIT16,1:I=INP(17):I$=CHR$(I):IA=I-128:I=I-176:GOTO752
799 REM **SUB TO TOTALIZE EACH ITEM
800 Y=0:FORM=1TO12:L=C(M,K):Y=Y+L:NEXTM:READX,X$:GOSUB966:RETURN
884 REM **INPUT SUB
885 WAIT16,1:I=INP(17):I$=CHR$(I):IA=I-128:I=I-176:GOSUB752:RETURN
889 REM **SUB TO INPUT TAPE
890 WAIT16,1:IA=INP(17):I=IA-48:I$=STR$(I):RETURN
899 REM * DEPOSIT SUB
900 GOSUB885:IFIA=32THENRETURN
902 IFIA=46THENGOSUB950:I2=I6:RETURN
903 IFIA=95THENI(1)=9999:RETURN
904 IFIA=>65THENF=1:I2$=I$:I(1)=9999:RETURN
906 IFIA=<47THENIFIA=>58THEN900
908 I(1)=I:FORK3=2TO4:GOSUB885:IFIA=32THEN922
910 IFIA=95THENI(1)=9999:RETURN
916 IFIA=46THENGOSUB950:GOTO924
917 IFIA<48ORIA>57THENI(1)=9999:RETURN
918 I(K3)=I:NEXTK3
922 I6=0
924 IFIA=95THENI(1)=9999:RETURN
925 K3=K3-1:K5=K3
927 REM  *MULTIPLIES INTEGERS
928 FORK4=1TOK3:X=10^(K3-1):IFX=0THENX=1
930 I(K4)=I(K4)*X:K3=K3-1:NEXTK4:K3=K5:I=0:FORK4=1TOK3:I=I+I(K4)
942 NEXTK4:I2=I+I6:RETURN
947 REM **PROCESSES DECIMAL
950 I6=0:GOSUB885:I6=I/10:IFIA=95THENI(1)=9999:RETURN
952 GOSUB885:IFIA=32THENRETURN
954 IFIA=95THENI(1)=9999:RETURN
958 I=I/100:I6=I6+I:RETURN
964 Y=0:FORK=1TO65:IFE(K,1)=XTHENY=Y+(E(K,2))
965 NEXTK:T=T+1:C(X,T)=Y:RETURN
966 PRINT"$";Y;TAB(6);"=";:RETURN
967 REM **PRINT TEAR LINE
968 FORTL=1TO71:PRINT"-";:NEXTTL:RETURN
969 REM **SETS STRING VARIABLES
1005 END
2000 DATA 65,"AUTO",66,"BUSINESS",67,"CASH",68,"HOBBIES"
2001 DATA 69,"EDUCATION",70,"FOOD",72,"HOUSEHOLD",77,"MEDICAL"
2002 DATA 80,"PAYCHECK",83,"SAVINGS",85,"UTILITIES",88,"EXTRAS"
2003 DATA 1,"EXPENDITURES THIS YEAR",1,"DEPOSITS THIS YEAR"
2004 DATA 1,"UNACCOUNTED MONIES    $"
OK
```

Programming the Human Computer

Vectored from Page 24

delights. Upon completion of his task, he executed an abrupt about-face, placed a single manual digit in a lateral juxtaposition to his olfactory organ, inclined his cranium forward and affected his egress by renegotiating the smoke passage.

He then propelled himself in a short vector onto his rustic winter conveyance. Contracting his oral sphincter, he emitted a shrill series of notes to the antlered quadropeds of burden and proceeded to soar aloft in a movement hitherto observable chiefly among the seed-bearing portions of a common weed. But I overheard his parting exclamation as he drove out of sight: "Happy Christmas To All and To All A Good Night." Peace!

Next month: how to get the most out of a computer convention.

Household Finance System II

By Francis Ascolillo

INTRODUCTION

HFS-II, the companion article to HFS I, is essentially a Report Generator Program which utilizes data developed and stored by HFS I to provide a lucid, obvious indicator of financial habits and trends, past, present and future. The reports are hard copy printouts with no tape provisions. If a tape is required, set NULL to NULL 3 and put the tape punch on when the prompt, "DO YOU HAVE A TAPE FOR" is answered before typing C/R.

The program operates on the data tapes produced by HFS I. It can be resident in memory at the same time as HFS I with automatic linking if the HFS II tape is read in after the HFS I tape has been entered and Line 10 is eliminated. The two programs have been separated to assure usefulness to users with limited (12K) memory. In practice, it is most often utilized on a quarterly basis. The program assumes that full data are available. If data are lacking, it will return an error message or adapt to the lack of data by eliminating those reports which are reliant upon the missing data.

OPERATION

Follow the prompts as they appear, being certain to enter the month numerically. After the present year's tape is read in, there will be a considerable delay while the data are being transferred between matrices. Wait until the next prompt appears. You will be given a choice of one of three types of reports. Remember that the ANNUAL REPORT is on a separate tape and unavailable unless read in separately. Type the number of the report desired or type "4" to end the program. After the current report is produced, the program returns to this area to provide the opportunity to produce another or all three types of reports if desired. TEARLINES separate each report for filing. These can be removed by eliminating GOSUB 968 in any lines where this instruction appears.

As with HFS I, the HFS II is intended to run in 12K memory with 8K MITS BASIC resident. Sections 1 and 2 of HFS II require all of the remaining memory to run and the ANNUAL REPORT has been provided as a separate program. With 16K, this routine can be resident at the same time with no problem.

The three reports are essentially self-contained so they can be extracted and run separately as long as the required subroutines are included.

FEATURES

This program generates the following reports as described below by typing in the number you desire:

1. YEAR TO DATE
2. PRIOR 12 MONTHS
3. ANNUAL REPORT
4. END PROGRAM

YEAR TO DATE

This portion produces a listing of the financial experience encountered in the present year to date, consisting of three distinct sections. It can be run anytime during the year and is intended for quarterly reports. In addition to providing totals, it will give average figures and changes in percent from the monthly average. If there is a significant change in any item in a month, analysis of that month might indicate problems or future changes required to prevent re-occurrence. A comparison to the same month of the previous year is available if a data tape for the previous year had been read in, and is invaluable to compensate for seasonal fluctuations to provide a more accurate picture. The effects of inflation normalization have not been included in this portion, but can be borne in mind while interpreting the results.

A COMMENT SECTION is included at the end of this portion to explain any unusual situation. This field is terminated by typing an asterisk(*), whereupon the program will ask if any additional reports are required. Type "4", if no.

YEAR TO DATE

SECTION I: TOTALS provides totals, in dollars, for each month in the present year plus the average monthly expenditure in dollars. All figures are provided in integers for greater visibility and ease in spotting trends. This will provide roundoff errors in the printout and some variations in the results, which are insignificant. The reason for any significant deviation from the average should be checked to determine its cause and likelihood of repeatability. This is when the MONTHLY REPORT generated by HFS I is utilized and is the reason for saving it as a reference source to obtain exact details of a problem area.

SECTION II: TREND provides a breakdown of the deviation from the YEAR TO DATE monthly average as found in any particular month. It is expressed as a PERCENTAGE, not dollars. A "-" sign indicates a drop in spending or a savings for that particular month over the yearly average and is desirable. Large incursions here will point out unusual expenditures. Reading an ITEM LINE from left to right will show what direction, (increasing or decreasing) your spending habits are heading during the present year. An unsigned number is "+" and, therefore, an increasing expense. In analyzing this, bear in mind that inflation will usually cause a steady, small increase as the year progresses. Don't lose track that these are percentages, not dollars.

In order to minimize the impact of an unusual or nonreoccurring monthly expense, the percent of deviation of any monthly item is limited to 100%. This will assure a more realistic picture of the trend. Wherever 100% occurs in the listing, it should be noted that the actual deviation can be any figure exceeding 100%.

In the same vein, the AVERAGE column is not arithmatically correct. This figure represents a weighted average and makes each succeeding month 10% more significant than the preceding month. Thus, the AVG will be a clear indicator of what is happening lately, as a trend, and provides a more accurate basis for evaluating future experience. This is intended to show what increase or decrease can be expected next month over this month's figures.

At first, this section can be confusing, as it is expressed in percent, not dollars, and a "-" shows a favorable trend.

SECTION III: Change from prior year is intended to show the difference in PERCENTAGE of spending from the same month last year, during each month, for each item and the current year. There is a limitation factor of 100% applied to the results to modify the effect of an unusual monthly experience in either year. This means that the average change, while not arithmetically correct, will provide a more realistic view of changes between years on the whole and will partially disregard any major unusual circumstances.

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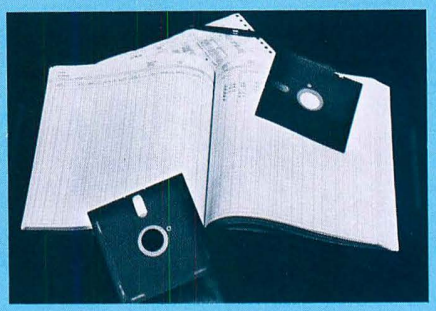

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CIRCLE INQUIRY NO. 34

This section eliminates fluctuations because of seasonal changes such as high winter heating bills, but will not appear at all unless tha tape data are available for the preceding year.

PRIOR TWELVE MONTHS

This provides a clear picture of your financial experience over the course of the past year and by careful analysis will show spending peaks peculiar to your household such as birthdays, school, Yule spending, etc. The first section is expressed in dollars with the average being a straight arithmetic average.

The second section shows the deviation from the average as expressed above, expressed in PERCENTAGE (not dollars). This is also a weighted average increasing 10% in importance each month to provide an accurate indicator fo future spending direction. Again, a "-" indicates decreasing spending and is desirable.

A data tape from the preceding year is necessary to run this portion of the program. The COMMENTS SECTION available at the end of this portion should be used to note any factors that are known to have caused large fluctuations in any of the figures.

ANNUAL REPORT

As its name implies, it is intended to be run at the end of the year. It cannot be run unless "LATEST DATA AVAILABLE" is answered with "12,*year*." It will provide totals of the past and present years for each item and extrapolate for the coming year based upon past experience and inflation. The inflation factors are contained in line 2005 data statement. These can be changed as the economy changes by simply adding the inflation rate to 100 (5% = 1.05). TREND shows the direction and rate of anticipated future change, expressed as a percentage, for each item. A "-" sign shows a decrease.

The BUDGET column shows the PERCENTAGE deposit dollars consumed by the particular item and what portion of your income will go to a particular item. These will not add up to 100% because of "missing" or unallocated monies, but they do show where your monies are concentrated. There well may be some surprises here and a concentrated effort to affect these percentages in the future can be an effective money management basis.

This program is separated from the rest and is complete in itself on a separate tape for several reasons. Namely, for 12K users, it does not fit with the rest of HFS II resident and must be used singly. Users with larger memory must add Line 1457 CLEAR: FOR X5 = 1 TO 15:READ Z, Z$: NEXT X5 to access inflation percentages, then read in the ANNUAL REPORT TAPE over the other HFS I and HFS II tapes already resident in memory.

Secondly, since this program is only used once a year, it seems impractical to waste memory space. It is possible, however, to read in all three tapes preserving the remark statements if desired, and repunching a single tape which should run in 16K of memory.

CONCLUSION

This program is intended to be an aid in analyzing your financial habits and a basis for providing future corrections. Concentrate on the ITEM which displays the most unfavorable trend during the last MONTHLY REPORT. Attempt to reduce it to a negative factor in the current month. By focusing upon one particular area at a time, you will probably begin to notice minor faults in your financial management that are relatively easy to correct. This is in fact an "Information Feedback" approach, that will assist you in restraining or upgrading your dollar utilization skills. Biofeedback devices utilize this same principle of allowing the user to become aware of the effects of a particular act or tendency. In this context the subject is spending.

Among many other uses, the program provides a basis for communication, exchange of ideas and intent among the members of the household. It provides documentation necessary at times to discuss a problem area and is very difficult to dispute or ignore.

Most importantly, you will find that understanding and application of the information provided by the program, coupled with some innovation, will teach you to gain and maintain control of your finances, rather than being a victim of them.

EXAMPLE: YEAR TO DATE REPORT

```
RUN
WHAT IS LATEST DATA AVAILABLE (TYPE M,Y)? 5,77
DO YOU HAVE A TAPE FOR 1977 ? Y
MOUNT 1977 TAPE AND START TAPE READER
DO YOU HAVE A TAPE FOR 1976 ? Y
MOUNT 1976 TAPE AND START TAPE READER

WHAT KIND OF REPORT DO YOU WANT (TYPE #)
1 - YEAR TO DATE
2 - PAST 12 MONTHS
3 - ANNUAL REPORT
4 - END PROGRAM
? 1
```

YEAR TO DATE 1977

TOTALS

ITEM	JAN	FEB	MAR	APR	MAY	AVG.	
AUTO	96	126	126	128	234	142	
BUSN	38	15	20	20	99	38	
CASH	45	85	73	150	135	97	
HOBY	30	23	49	1	14	23	
EDUC	361	26	12	14	13	85	
FOOD	170	203	214	207	231	205	
HOUS	267	266	266	266	310	275	
MED	5	14	18	0	24	12	
PAY	0	0	0	0	0	0	
SAV	50	50	50	50	50	50	
UTIL	206	186	153	147	171	173	
XTRA	152	101	67	166	137	125	
EXP.	1423	1098	1053	1152	1422	1230	
DEP.	1749	1095	1634	1125	1047	1330	

TREND FOR 1977

% OF CHANGE FROM 1977 AVERAGE

ITEM	JAN	FEB	MAR	APR	MAY	AVG.
AUTO	-33	-12	-11	-10	65	3
BUSN	2	-61	-48	-48	162	6
CASH	-54	-13	-25	54	39	4
HOBY	34	1	116	-95	-40	-1
EDUC	324	-70	-86	-83	-84	-14
FOOD	-17	-1	4	1	12	0
HOUS	-3	-4	-4	-4	12	-1
MED	-59	24	55	0	107	30
PAY	0	0	0	0	0	0
SAV	0	0	0	0	0	0
UTIL	19	7	-12	-15	-1	-2
XTRA	21	-20	-46	33	9	-1
EXP.	15	-11	-15	-7	15	-1
DEP.	31	-18	22	-16	-22	-3

CHANGE 1976 TO 1977

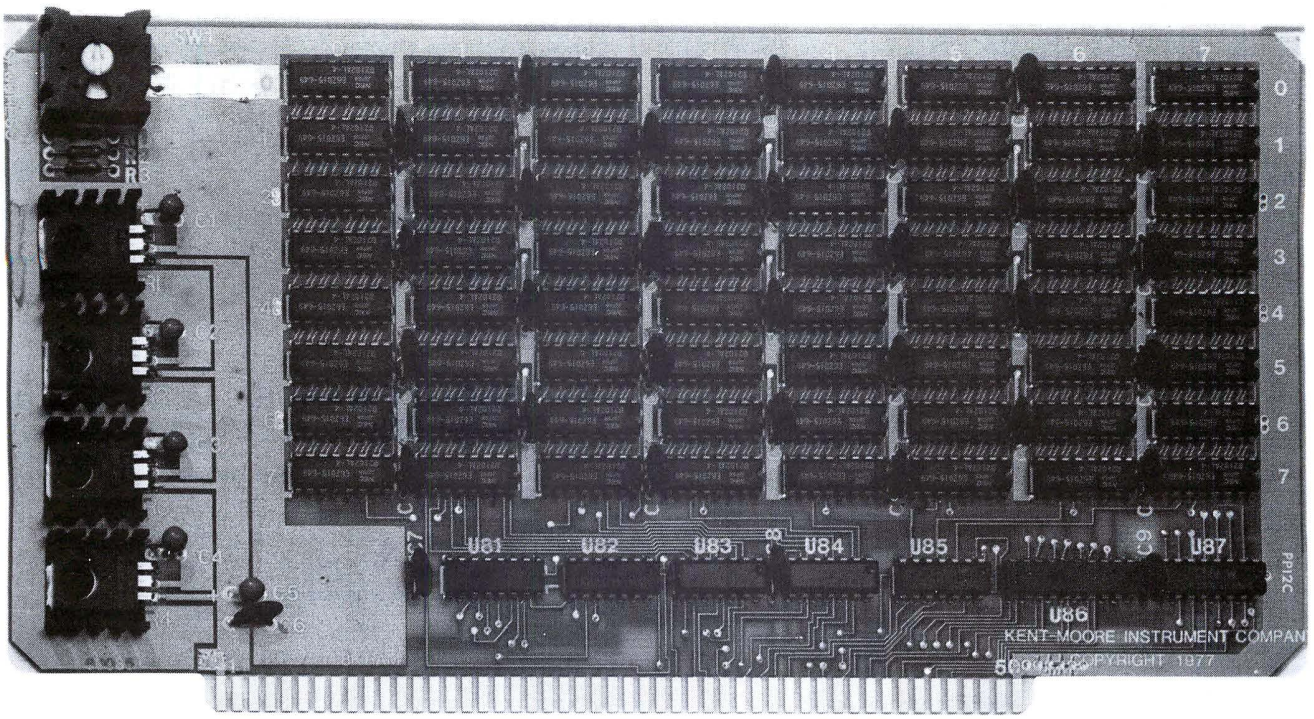
ITEM	JAN	FEB	MAR	APR	MAY	AVG.
AUTO	-80	-13	-60	94	100	14
BUSN	100	-80	100	33	-99.7	5
CASH	-63	-30	-27	3	68	-5
HOBY	-90	-98	-48	-100	-85	-78
EDUC	100	15	-31	-48	-59	-11
FOOD	-34	-12	1	-33	21	-10
HOUS	2	2	2	2	18	5
MED	-59	100	-14	-100	100	6
PAY	0	0	0	0	0	0
SAV	-98	0	0	-50	-17	-29
UTIL	42	1	-24	-21	9	-1
XTRA	-41	-89	-74	27	-83	-48
EXP.	-64	-64	-32	-46	-20	-41
DEP.	51	1	65	0	-55	8

COMMENTS:
NONE AT THIS TIME

EXAMPLE: PRIOR 12 MONTHS REPORT

```
WHAT KIND OF REPORT DO YOU WANT (TYPE #)
1 - YEAR TO DATE
2 - PAST 12 MONTHS
3 - ANNUAL REPORT
4 - END PROGRAM
? 2
```

MORE BYTES FOR YOUR BUCK !



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Both boards have fully buffered address and data lines, and extensive built-in noise immunity circuitry. And are plug-in compatible with the S-100 bus (Altair 8800, IMSA1 8080, etc.)

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Also available: 4K RAM; $107.00, Alpha-VDM; $107.00, Alpha-VDM-II; $145.00, Graphics-VDM; $137.00.

Order direct by check, BankAmericard or Master Charge (Add $1.50 shipping, credit customers give us all the card numbers, please and Ohio residents add 4½% sales tax) or contact us for more information. Kent-Moore Instrument Company, a subsidiary of Kent-Moore Corporation (founded in 1919), P.O. Box 507, Industrial Ave., Pioneer, Ohio 43554. (419) 737-2352. Or, Kent-Moore of Canada, 246 S. Cawthra Rd., Mississauga, Ontario L-A3P2, Canada.

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```
                PERIOD FROM JUN 1976 TO MAY 1977

      1976                                    1977

ITEM  JUN   JUL   AUG   SEP   OCT   NOV   DEC   JAN   FEB   MAR   APR   MAY   AVG.
AUTO  72    78    71    91    70    188   125   96    126   126   128   234   117
BUSN  14    129   4     27    4     79    11    38    15    20    20    99    38
CASH  85    70    155   60    75    110   100   45    85    73    150   135   95
HOBY  62    51    89    67    69    74    77    30    23    49    1     14    51
EDUC  17    15    205   0     37    12    17    361   26    12    14    13    61
FOOD  151   258   222   217   250   225   271   170   203   214   207   231   218
HOUS  271   260   261   260   260   267   266   267   266   266   266   310   268
MED   2     6     0     2     56    37    25    5     14    18    0     24    16
PAY   0     0     0     0     0     0     0     0     0     0     0     0     0
SAV   0     0     50    50    50    50    50    50    50    50    50    50    41
UTIL  106   94    90    95    82    102   125   206   186   153   147   171   130
XTRA  392   81    650   93    304   157   41    152   101   67    166   137   195
EXP.  1177  1046  1801  966   1261  1305  1111  1423  1098  1053  1152  1422
                                                                        1235
DEP.  1139  1584  1086  1229  1182  1157  1183  1749  1095  1634  1125  1047
                                                                        1268

                      TREND - PAST 12 MONTHS

% OF CHANGE FROM 1977 AVERAGE

ITEM  JUN   JUL   AUG   SEP   OCT   NOV   DEC   JAN   FEB   MAR   APR   MAY   AVG.
AUTO -38   -33   -40   -23   -41   60    6     -19   7     7     9     99    6
BUSN -62    100 -88   -29   -88   100 -72     0   -62   -49   -49    100 -15
CASH -11   -27   62    -38   -22   15    4     -53   -11   -24   57    41    2
HOBY  22   -1    75    32    35    46    52    -40   -55   -3    -98   -73   -9
EDUC -73   -76   100 -100 -39   -80   -72    100 -57   -80   -77   -78   -46
FOOD -31   18    1     -1    14    3     24    -23   -8    -3    -5    5     0
HOUS  1    -4    -3    -4    -4    -1    -1    -1    -1    -1    -1    15    0
MED  -82   -61   -100 -85    100   100   54    -70   -8    14    0     53    0
PAY   0     0     0     0     0     0     0     0     0     0     0     0     0
SAV  -100 -100   19    19    19    19    19    19    19    19    19    19    6
UTIL -18   -28   -31   -27   -37   -22   -4    58    43    18    13    31    5
XTRA  100 -59    100 -53    55    -20   -79   -23   -49   -66   -15   -30   -18
EXP. -5    -16   45    -22   2     5     -10   15    -12   -15   -7    15    -1
DEP. -11   24    -15   -4    -7    -9    -7    38    -14   28    -12   -18   -1

COMMENTS:
NONE AT THIS TIME

-----------------------------------------------------------------------
WHAT KIND OF REPORT DO YOU WANT (TYPE #)
1 - YEAR TO DATE
2 - PAST 12 MONTHS
3 - ANNUAL REPORT
4 - END PROGRAM
? 4

OK
```

EXAMPLE: PII-ANNUAL REPORT

```
RUN
WHAT IS LATEST DATA AVAILABLE (TYPE M,Y)? 12,77
DO YOU HAVE A TAPE FOR 1977 ? Y
MOUNT 1977 TAPE AND START TAPE READER
DO YOU HAVE A TAPE FOR 1976 ? Y
MOUNT 1976 TAPE AND START TAPE READER

WHAT KIND OF REPORT DO YOU WANT (TYPE #)
1 - YEAR TO DATE
2 - PAST 12 MONTHS
3 - ANNUAL REPORT
4 - END PROGRAM
? 3
WHAT IS STARTING BALANCE ON JAN 1, 1977 ? 433

-----------------------------------------------------------------------

                      ANNUAL REPORT 1977

ITEM        1976        1977        1978        TREND       BUDGET

AUTO        1787        712         303         -61          10

BUSN        375         193         99          -49          2

CASH        1220        488         215         -60          7

HOBY        2897        119         5           -96          1

EDUC        413         428         456          3           6

FOOD        2794        1027        423         -64          15

HOUS        3153        1377        632         -57          20

MED         203         63          21          -69          0

PAY         0           0           0           -100         0

SAV         2460        250         26          -90          3

UTIL        1568        865         549         -45          13

XTRA        4045        625         106         -85          9

EXP.        20920       6150        2079        -71
DEP.        15229       6652        4939        -57

ASSETS ACCRUED THIS YEAR        7085.12

MONIES NOT ACCOUNTED FOR        501

DEPOSITS                        6652.12
START BALANCE                   433
SAVINGS                         250
                                -------
ASSETS                          7335.12

KNOWN SPENT                     6150.34
                                -------
REMAINING ?                     1184

-----------------------------------------------------------------------
WHAT KIND OF REPORT DO YOU WANT (TYPE #)
1 - YEAR TO DATE
2 - PAST 12 MONTHS
3 - ANNUAL REPORT
4 - END PROGRAM
? 4

OK
```

HOUSEHOLD FINANCE SYSTEM II PROGRAM

```
LIST

1 REM      ** HOUSEHOLD FINANCE SYSTEM II **
2 REM              BY FRANCIS ASCOLILLO
10 GOTO1004
299 REM  HEADER MONTH LINE
300 PRINT"ITEM";TAB(6);:FORM=1TOM1
305 GOSUB1930
307 PRINTSPC(2);:NEXTM:PRINTB$:RETURN
310 PRINT"JAN";:RETURN
311 PRINT"FEB";:RETURN
312 PRINT"MAR";:RETURN
313 PRINT"APR";:RETURN
314 PRINT"MAY";:RETURN
315 PRINT"JUN";:RETURN
316 PRINT"JUL";:RETURN
317 PRINT"AUG";:RETURN
318 PRINT"SEP";:RETURN
319 PRINT"OCT";:RETURN
320 PRINT"NOV";:RETURN
321 PRINT"DEC";:RETURN
595 REM **READ TAPE
596 WAIT16,1:IA=INP(17)
597 IFIA=<A5THEN596
598 IFIA=>58THENRETURN
599 M=IA-48:WAIT16,1:IA=INP(17):IFIA<>32THENM=10+(IA-48)
601 FORJ=A8TOA7:V=0:V1=0
604 WAIT16,1:IA=INP(17)
605 IFIA<46THEN604
606 D7=1:IFIA=46THEN630
607 D(D7)=IA-48:WAIT16,1:IA=INP(17):IFIA=46THEN630
608 IFIA>45THEND7=D7+1:GOTO607
609 M$="":FORX=1TOD7:M$=M$+STR$(D(X)):NEXTX
610 C(M,J)=V+VAL(M$):NEXTJ:GOTO596
630 WAIT16,1:IA=INP(17):V=0:V1=0:IFIA=32THEN609
632 V1=IA-48:WAIT16,1:IA=INP(17):IFIA=32THENV=V1/10:GOTO609
636 V=(V1/10)+(IA-48)/100:GOTO609
967 REM **PRINT TEAR LINE
968 FORTL=1TO71:PRINT"-";:NEXTTL:RETURN
970 REM  LINE TITLE
971 PRINT"AUTO";:RETURN
972 PRINT"BUSN";:RETURN
973 PRINT"CASH";:RETURN
974 PRINT"HOBY";:RETURN
975 PRINT"EDUC";:RETURN
976 PRINT"FOOD";:RETURN
977 PRINT"HOUS";:RETURN
978 PRINT"MED";:RETURN
979 PRINT"PAY";:RETURN
980 PRINT"SAV";:RETURN
981 PRINT"UTIL";:RETURN
982 PRINT"XTRA";:RETURN
983 PRINT"EXP.";:RETURN
984 PRINT"DEP.";:RETURN
985 PRINT"LOST";:RETURN
989 REM **ERROR MESSAGE
990 PRINT"INSUFFICIENT DATA TO PROCESS";:RETURN
995 PRINT" NEED DATA FOR";:RETURN
1000 REM ** H.F.S. II **
1004 DIMC(12,15),C1(12,15),D(15),F(15):GOTO1010
1005 INPUT"DO YOU WANT FINANCIAL REPORT";Q$
1006 IFLEFT$(Q$,1)="N"THENEND
1010 INPUT"WHAT IS LATEST DATA AVAILABLE (TYPE M,Y)";M1,Y1
1011 A5=48:A7=15:A8=1:IFY1<1900THENY1=Y1+1900
1012 IFY1<1900THENY1=Y1+1900
1013 REM **CHECK FOR DATA AVAILABLE
1015 T=0:FORJ=1TO12:T=T+C(M1,J):NEXTJ:IFT>0THEN1025
1017 REM **NEED DATA, GET TAPE
1020 Y2=Y1:GOSUB1900:IFQX=1THENGOSUB990:GOTO1010
1023 REM **TRANSFER MAT 1 TO MAT 2
1025 FORK=1TO12:FORJ=1TO15:C1(K,J)=C(K,J):NEXTJ:NEXTK
1028 Y2=Y1-1:GOSUB1900:PRINT
1030 PRINT"WHAT KIND OF REPORT DO YOU WANT (TYPE #)"
1031 PRINT"1 - YEAR TO DATE"
1032 PRINT"2 - PAST 12 MONTHS"
1033 PRINT"3 - ANNUAL REPORT"
1034 PRINT"4 - END PROGRAM"
1035 INPUTQ:ONQGOTO1040,1205,1400,1600
1037 REM **YEAR TO DATE
1040 PRINT:GOSUB968:PRINT:PRINT
1045 PRINTTAB(22);"YEAR TO DATE";Y1:PRINT:PRINT:PRINTTAB(29);"TOTALS"
1053 REM **PRINT HEADER
1055 PRINT:PRINT:B$="AVG.":GOSUB300:PRINT:FORL1=1TO14
1060 GOSUB1940
1065 TB=5:PRINTTAB(TB);:LT=0:FORM=1TOM1:TB=TB+5:LT=LT+C1(M,L1)
1070 PRINTINT(C1(M,L1));TAB(TB);:NEXTM:D(L1)=INT(LT/M1):PRINTD(L1)
1071 NEXTL1
```

```
1079 REM  YTD DEVIATION
1080 PRINT:PRINT:PRINTTAB(25);"TREND FOR";Y1:PRINT:PRINT
1082 PRINT"% OF CHANGE FROM";Y1;"AVERAGE":PRINT:PRINT
1085 PRINT:B$="AVG.":GOSUB300:PRINT:FORL1=1TO14
1090 GOSUB1940
1095 TB=5:PRINTTAB(TB);:FM=1:FT=0:FORM=1TOM1:GOSUB1920
1115 X=INT(X):TB=TB+5:F(L1)=F(L1)+(X*FM):FT=FT+FM:FM=FM+.1
1120 PRINTX;TAB(TB);:NEXTM:PRINTINT(F(L1)/FT):NEXTL1
1130 REM **  YTD YEAR TO YEAR
1135 PRINT:PRINT:PRINTTAB(25);"CHANGE";Y1-1;"TO";Y1:PRINT:PRINT
1140 IFQX=1THENGOSUB990:GOSUB995:PRINTY1-1:GOSUB968:GOTO1030
1145 PRINT:B$="AVG.":GOSUB300:PRINT:FORL1=1TO14
1150 GOSUB1940
1155 TB=5:PRINTTAB(TB);:D(L1)=0:FM=1:FT=0:FORM=1TOM1
1160 IFC(M,L1)=0THENX=0-C(M,L1):GOTO1170
1165 X=INT(((C(M,L1)/C(M,L1))*100)-100):GOSUB1945
1170 TB=TB+5:PRINTX;TAB(TB):D(L1)=D(L1)+(X*FM):FM=FM+.1:FT=FT+FM
1173 NEXTM:PRINTINT(D(L1)/FT)
1175 NEXTL1:GOTO1950
1180 FORA=1TO72:WAIT16,1:I=INP(17):I$=CHR$(I):IA=I-128
1185 IFIA=32ANDA=>60THENPRINT:GOTO1180
1190 IFIA=42THENPRINT:PRINT:PRINT:GOTO1195
1192 PRINTI$;:NEXTA
1195 GOSUB968:PRINT:GOTO1030
1200 REM  PRIOR 12 MONTHS
1205 IFQX=1THENGOSUB990:GOSUB995:PRINTY1-1:GOTO1028
1215 GOSUB968:PRINT:PRINT:PRINT:M3=M1+1
1220 PRINTTAB(20);"PERIOD FROM ";:M=M3:GOSUB1930:PRINTY1-1;"TO ";
1225 M=M1:GOSUB1930:PRINTY1:PRINT:PRINT:PRINT
1230 PRINTTAB(5);Y1-1;TAB((13-M1)*5);Y1:PRINT:GOSUB1925
1235 FORL1=1TO14:GOSUB1940:TB=5:PRINTTAB(TB);:D(L1)=0
1240 FORM=M3TO12:TB=TB+5:D(L1)=D(L1)+C(M,L1):GOSUB1942:NEXTM
1245 FORM=1TOM1:TB=TB+5:D(L1)=D(L1)+C(M,L1):GOSUB1944:NEXTM
1250 D(L1)=D(L1)/12:PRINTINT(D(L1));:NEXTL1:PRINT:PRINT:PRINT
1252 REM ** PRIOR 12 MONTHS PART 2
1255 PRINTTAB(23);"TREND - PAST 12 MONTHS": PRINT:PRINT:PRINT
1260 PRINT"% OF CHANGE FROM";Y1;"AVERAGE":PRINT:PRINT
1265 GOSUB1925:PRINT:FORL1=1TO14:GOSUB1940:TB=5:PRINTTAB(TB);
1270 F(L1)=0:FM=1:FT=0:FORM=M3TO12:GOSUB1923:GOSUB1980:NEXTM
1280 FORM=1TOM1:GOSUB1920:GOSUB1980:NEXTM
1285 PRINTINT(F(L1)/FT):NEXTL1
1300 GOTO1950
1400 GOTO1030
1600 END
1900 PRINT"DO YOU HAVE A TAPE FOR";Y2;:INPUTQ$
1910 QX=0:IFLEFT$(Q$,1)="N"THENQX=1:RETURN
1912 PRINT"MOUNT";Y2;"TAPE AND START TAPE READER":GOSUB596:RETURN
1919 REM  CALC %
1920 IFD(L1)=0THENX=0-C(M,L1):RETURN
1921 IFC1(M,L1)=0THENX=0:RETURN
1922 X=((C1(M,L1)/D(L1))*100)-100):RETURN
1923 IFD(L1)=0THENX=0-C(M,L1):RETURN
1924 X=((C(M,L1)/D(L1))*100)-100):RETURN
1925 B$="AVG.":PRINT"ITEM";TAB(6);:FORM=M3TO12:GOSUB1930:PRINTSPC(2);
1926 NEXTM
1927 FORM=1TOM1:GOSUB1930:PRINTSPC(2);:NEXTM:PRINTB$:RETURN
1930 ONMGOSUB310,311,312,313,314,315,316,317,318,319,320,321322
1931 RETURN
1940 ONL1GOSUB971,972,973,974,975,976,977,978,979,980,981,982,983,984
1941 RETURN
1942 PRINTINT(C(M,L1));TAB(TB);:RETURN
1944 PRINTINT(C1(M,L1));TAB(TB);:RETURN
1945 IFX>100THENX=100:RETURN
1947 IFX<-100THENX=-100:RETURN
1948 RETURN
1950 PRINT:PRINT"COMMENTS:"
1955 FORA=1TO72:WAIT16,1:I=INP(17):I$=CHR$(I):IA=I-128
1960 IFIA=32ANDA=>60THENPRINT:GOTO1955
1965 IFIA=42THENPRINT:PRINT:PRINT:GOTO1975
1970 PRINTI$;:NEXTA
1975 GOSUB968:PRINT:GOTO1030
1980 GOSUB1945:F(L1)=F(L1)+(X*FM):FT=FT+FM:FM=FM+.1
1985 TB=TB+5:PRINTINT(X);TAB(TB):RETURN
OK
```

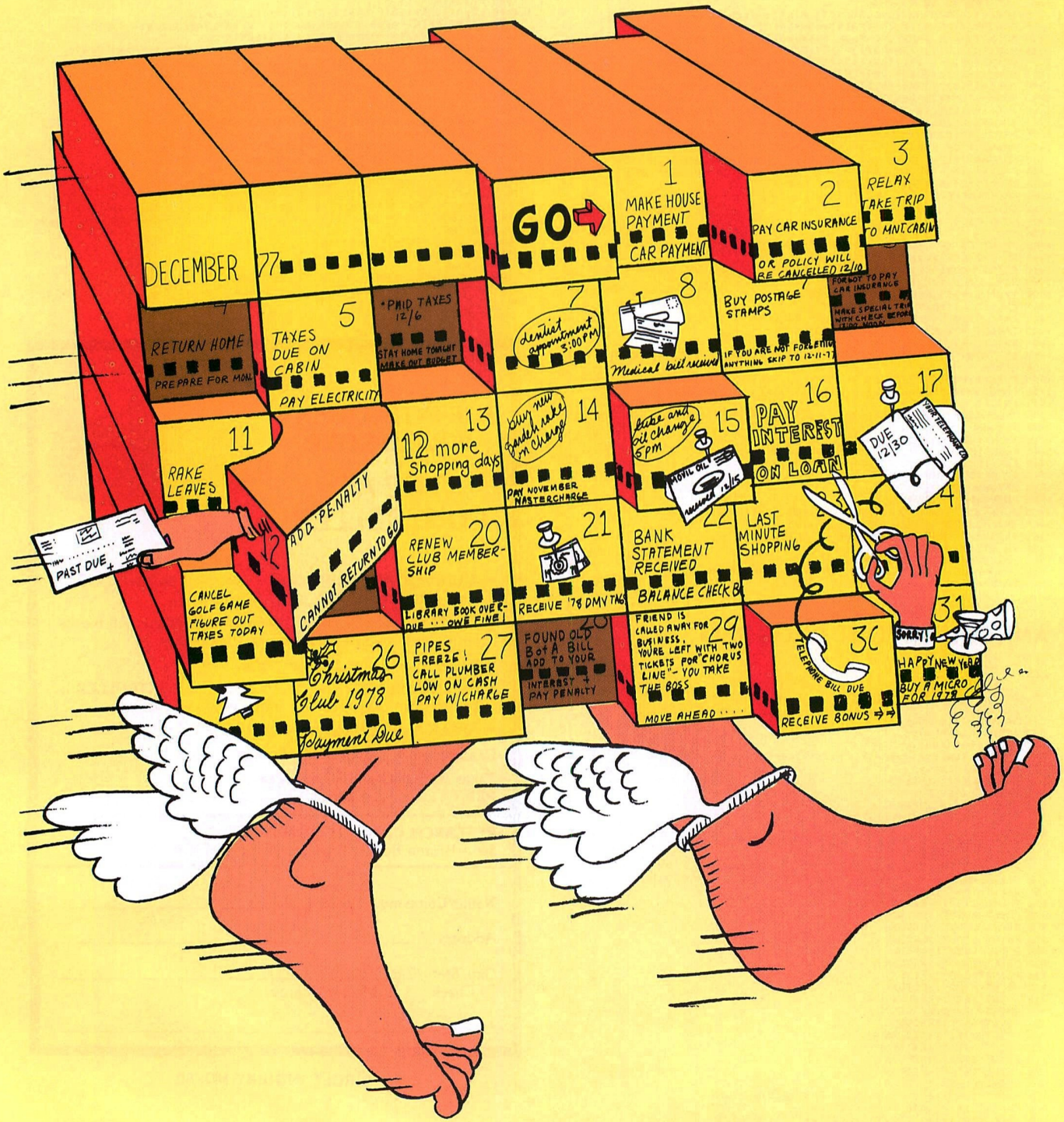
ANNUAL REPORT PROGRAM

```
LI
LIST

10 GOTO1004
194 RETURN
596 WAIT16,1:IA=INP(17)
597 IFIA=<A5THEN596
598 IFIA=>58THENRETURN
599 M=IA-48:WAIT16,1:IA=INP(17):IFIA<>32THENM=10+(IA-48)
601 FORJ=A8TOA7:V=0:V1=0
604 WAIT16,1:IA=INP(17)
605 IFIA<46THEN604
606 D7=1:IFIA=46THEN630
607 D(D7)=IA-48:WAIT16,1:IA=INP(17):IFIA=46THEN630
608 IFIA>45THEND7=D7+1:GOTO607
609 M$="":FORX=1TOD7:M$=M$+STR$(D(X)):NEXTX
610 C(M,J)=V+VAL(M$):NEXTJ:GOTO596
630 WAIT16,1:IA=INP(17):V=0:V1=0:IFIA=32THEN609
632 V1=IA-48:WAIT16,1:IA=INP(17):IFIA=32THENV=V1/10:GOTO609
636 V=(V1/10)+(IA-48)/100:GOTO609
968 FORTL=1TO71:PRINT"-";:NEXTTL:RETURN
971 PRINT"AUTO";:RETURN
972 PRINT"BUSN";:RETURN
973 PRINT"CASH";:RETURN
974 PRINT"HOBY";:RETURN
975 PRINT"EDUC";:RETURN
976 PRINT"FOOD";:RETURN
977 PRINT"HOUS";:RETURN
978 PRINT"MED";:RETURN
979 PRINT"PAY";:RETURN
980 PRINT"SAV";:RETURN
981 PRINT"UTIL";:RETURN
982 PRINT"XTRA";:RETURN
983 PRINT"EXP.";:RETURN
984 PRINT"DEP.";:RETURN
985 PRINT"LOST";:RETURN
990 PRINT"INSUFFICIENT DATA TO PROCESS";:RETURN
995 PRINT" NEED DATA FOR";:RETURN
1004 DIMC(12,15),C1(12,15),D(15),F(15):GOTO1010
1010 INPUT"WHAT IS LATEST DATA AVAILABLE (TYPE M,Y)";M1,Y1
1011 A5=48:A7=15:A8=1:IFY1<1900THENY1=Y1+1900
1012 IFY1<1900THENY1=Y1+1900
1015 T=0:FORJ=1TO12:T=T+C(M1,J):NEXTJ:IFT>0THEN1025
1020 Y2=Y1:GOSUB1900:IFQX=1THENGOSUB990:GOTO1010
1025 FORK=1TO12:FORJ=1TO15:C1(K,J)=C(K,J):NEXTJ:NEXTK
1028 Y2=Y1-1:GOSUB1900:PRINT
1030 PRINT"WHAT KIND OF REPORT DO YOU WANT (TYPE #)"
1031 PRINT"1 - YEAR TO DATE"
1032 PRINT"2 - PAST 12 MONTHS"
1033 PRINT"3 - ANNUAL REPORT"
1034 PRINT"4 - END PROGRAM"
1035 INPUTQ:ONQGOTO1040,1205,1400,1600
1399 REM ** ANNUAL REPORT
1400 IFM1<12THEN1010
1410 PRINT"WHAT IS STARTING BALANCE ON JAN 1,";Y1;:INPUTB1
1415 PRINT:GOSUB968:PRINT:PRINT:PRINT
1420 PRINTTAB(25);"ANNUAL REPORT";Y1:PRINT:PRINT:PRINT
1425 PRINT"ITEM";TAB(10);Y1-1;TAB(20);Y1;TAB(30);Y1+1;TAB(40);
1430 PRINT"TREND";TAB(50);"BUDGET"
1435 PRINT:FORL1=1TO14:GOSUB1940:D(L1)=0:TB=10:PRINTTAB(TB);
1436 TB=TB+10
1440 FORM=1TO12:D(L1)=D(L1)+C(M,L1):NEXTM:PRINTINT(D(L1));TAB(TB);
1450 F(L1)=0:FORM=1TO12:F(L1)=F(L1)+C(M,L1):NEXTM:TB=TB+10
1452 IFD(L1)=0THEND(L1)=1
1455 PRINTINT(F(L1));TAB(TB);:X=(((F(L1)/D(L1))*100)-100):GOSUB1945
1460 READY:TB=TB+10:PRINTINT(((X/100)+1)*F(L1)*Y);TAB(TB);:NT(X);
1465 GOSUB1490:TB=TB+10
1466 IFL1<13THENPRINTTAB(TB);INT((F(L1)/FT)*100)
1467 PRINT:NEXTL1
1468 LT=0:FORM=1TO12:LT=LT+C1(M,14):NEXTM:PRINT
1470 PRINT:PRINT"ASSETS ACCRUED THIS YEAR";TAB(30);B1+LT:PRINT
1472 FM=0:FORM=1TO12:FM=FM+C1(M,13):NEXTM
1474 IF(LT-FM)<0THENPRINT"DEBT INCURRED";TAB(30);LT-FM:GOTO1478
1476 PRINT"MONIES NOT ACCOUNTED FOR";TAB(30);INT(LT-FM):PRINT
1478 FT=0:FORM=1TO12:FT=FT+C1(M,10):NEXTM:PRINT:PRINT
1480 PRINT "DEPOSITS";TAB(20);LT:PRINT"START BALANCE";TAB(20);B1
1482 PRINT"SAVINGS";TAB(20);FT:PRINTTAB(21);"-------"
1484 PRINT "ASSETS";TAB(20);LT+B1+FT:PRINT
1486 PRINT"KNOWN SPENT";TAB(20);FM:PRINTTAB(21);"-------"
1488 PRINT "REMAINING ?";TAB(20);INT(LT+B1+FT-FM)
1489 FORJ=1TO10:PRINT:NEXTJ:GOSUB968:PRINT:GOTO1030
1490 FT=0:FORJ=1TO12:FT=FT+C1(J,14):NEXTJ:RETURN
1600 END
1900 PRINT"DO YOU HAVE A TAPE FOR";Y2;:INPUTQ$
1910 QX=0:IFLEFT$(Q$,1)="N"THENQX=1:RETURN
1912 PRINT"MOUNT";Y2;"TAPE AND START TAPE READER":GOSUB596:RETURN
1940 ONL1GOSUB971,972,973,974,975,976,977,978,979,980,981,982,983,984
1941 RETURN
1945 IFX>100THENX=100:RETURN
1947 IFX<-100THENX=-100:RETURN
1948 RETURN
1985 TB=TB+5:PRINTINT(X);TAB(TB):RETURN
2005 DATA1.07,1,1.1,1.08,1.03,1.12,1.05,1.09,1,1.05,1.15,1.1,1.15,1.7
OK
```

Personal Accounts Payable Program

By Kevin Redden*



In January of 1977, I received a notice of a bill that was past due from a credit card company whose card I held. I had apparently misplaced or overlooked the bill during the previous month, and now in addition to having an account in arrears, I had been assessed with an interest penalty. After getting over my annoyance at having let this happen, I decided to make some practical use of the microcomputer system that had been acting as a money sink for the past twelve months, and was also occupying an inordinate amount of real estate in the den. The result of the ensuing labors was the personal accounts payable program described in this article.

The program keeps track of bills received, payments made on those bills, and of such pertinent data as when the bill was received, when it was due to be paid, when it was actually paid, how much interest was added that month, the minimum payment due, the total amount due, and the amount actually paid. Reports available include listings of the status of all accounts, the status of only current accounts (those with bills outstanding), the history of all accounts and the history of selected accounts. The personal accounts payable program was written in TDL 8K BASIC, but with slight modification will run with any BASIC that provides string manipulation (left$, right$, and mid$ functions). A minimum of 24K of memory is required, 8K for the BASIC interpreter, 13K for the program code, and a minimum of 3K for the file storage.

Running the program consists of loading the program into the machine and typing the run command. The program starts by asking for the current date, after which the menu screen is displayed.

While the program may be run satisfactorily on a teletype, it was written to run on a CRT, and as such provides for various 'screens', i.e. complete pictures of data such as the opening menu screen. This screen is a listing of all functions available to the user and is shown in Figure 1. From this point, the user can select any of the available options. Any response other than the allowed options will cause the menu screen to be repeated.

```
KR ACCOUNTS PAYABLE SYSTEM                    DATE: 10/27/77

ALLOWABLE OPTIONS ARE:

          L=LIST ACCOUNTS              LC=LIST CURRENT ACCOUNT
          W=WRITE TAPE                 R=READ TAPE
          E=ENTER UPDATE               D=DELETE RECORD
          S=SORT ON DUE DATE           SN=SORT BY ACC.#
          PA=PRINT HISTORY OF          PS=PRINT HISTORY OF
             ALL ACCOUNTS                 SELECTED ACCOUNT
          P=PAY BILL                   DO=DOODLE ON CRT


ENTER OPTION?
```

The data file for the program is stored as a sequential ASCII file on cassette or disc between program runs, but is loaded totally into core during execution. While this demands a larger memory than would a random access disc type file, it greatly increases execution speed, allowing the use of the program on non-disc systems. At one time I kept the data file on paper tape. The requirement for a large amount of memory can be alleviated by periodically purging old records to keep the file size within reason.

The file consists of one 'current account record' and one or more 'history records' for each account. The data in each record are in ASCII, and the layouts of these two types of records is shown in Figure 2.

```
CURRENT ACCOUNT RECORD:

      BYTE     1 = "." (PERIOD) - DENOTES START OF RECORD
      BYTE   2-3 = ACCOUNT NUMBER
      BYTE   4-8 = DATE BILL ENTERED (MMDDY)
      BYTE  9-13 = BILL DUE DATE (MMDDY)
      BYTE 14-19 = MINIMUM PAYMENT DUE
      BYTE 20-26 = TOTAL AMOUNT DUE
      BYTE 27-31 = INTEREST INCURED
      BYTE 32-51 = ACCOUNT NAME
      BYTE 52-53 = CARRIAGE RETURN/LINE FEED (END OF RECORD)


HISTORY RECORD FORMAT:

      BYTE     1 = "1" - DENOTES START OF RECORD
      BYTE   2-3 = ACCOUNT NUMBER
      BYTE   4-8 = DATE BILL ENTERED
      BYTE  9-13 = DATE BILL DUE
      BYTE 14-18 = DATE BILL PAID
      BYTE 19-24 = PAYMENT AMOUNT DUE
      BYTE 25-31 = TOTAL AMOUNT DUE
      BYTE 32-37 = AMOUNT ACTUALLY PAID
      BYTE 38-42 = INTEREST INCURED
      BYTE 43-44 = CARRIAGE RETURN/LINE FEED (END OF RECORD)
```

When first starting the program, the next operation after entering the date is normally reading the old file. Since most 8K BASICs do not allow a file (tape or disc) read capability, this is the one area where some careful programming tricks are required. The file read is accomplished by calling a subroutine that uses the poke command to change the address in the BASIC interpreter that calls the console input routine and inserts the address of the assembly language driver that inputs from the read device: tape reader, cassette player, or disc drive. The interpreter then thinks that the file read device is the console device and 'input' statements can be used to read the ASCII records. When the end-of-file record is read, the process is reversed and the original I/O vectors are restored, thereby returning control to the console. The same process is used for writing the file at the end of a session, with the only difference being that the console *out* routine is changed to point to the file write driver. While this may be difficult to set up (finding the right addresses to change is the major problem), once it is done, the rest of the program is quite straight forward.

Entering and paying of bills is fairly simple, as can be seen from the examples in Figure 3. The program prompts the user for all entries, and displays the entered data back for confirmation before actually entering the update into the file. A few extra features are performed when entering data that are not at first apparent in the listing. Any time a date is requested, if only a space is entered instead of the date, the program inserts the current date. This is useful to prevent entering the current date for date received when entering a new bill into the system. When entering a bill and the 'payment due' is

*Amateur Computer Group of New Jersey

equal to the 'total amount due' on the account, entering a space for the payment due amount causes the program to use the total amount for both values.

```
KR ACCOUNTS PAYABLE SYSTEM                    ACCOUNT UPDATE ROUTINE

ACCOUNT NUMBER ? 11
ACCOUNT NUMBER  11   IS DINERS CLUB
DATE PAYMENT IS DUE ? 11/01/77
TOTAL AMOUNT DUE (MAX 7) ? 437.22
PAYMENT AMOUNT DUE ? 437.22
INTEREST CHARGE ?
DATE BILL WAS RECEIVED ? 10/29/77

ACCOUNT # 11 - DINERS CLUB

PAYMENT OF $437.22 DUE ON 11/01/77      TOTAL DUE $ 437.22
FINANCE CHARGE $

ACCEPT UPDATE ? YES

ACCOUNT FILE UPDATED.



ENTER OPTION?
```

Figure 3. Entering a new bill.

The last option on the menu was added as an afterthought to keep the menu screen symmetrical! All the routine does is to use a random number generator to draw a pattern on the ADM-3A CRT screen. While it can be fascinating to see, it is also totally impractical!

To modify the program to run in BASICs other than TDL's 8K version, the following hints should be useful:

1. Change the 'LPRINT' statements to 'PRINT'.
2. Modify the file Read & Write routines to patch the correct addresses to the right values.
3. 1K of memory can be saved by deleting all 'REM' statements.
4. Additional memory can be saved by deleting the 'Doodle' routine, and the 'Sort by Account Number' routine. The latter is not used as much as the sort by due date, and can be omitted if in a pinch for memory.
5. Always devote as much free memory as possible to string space by changing the value in Line 600. This will allow larger data files to be accommodated, and will also speed execution by requiring fewer passes of the 'garbage collector' in the interpreter that retrieves used string space. This is especially true in speeding up sorts.
6. While sorting, the front panel lights are used to display the ASCII character of the current account record being examined. Since sorts can take from ten seconds to over a minute depending on file size, this feature lets an impatient user (like me) know that the CPU is still running while the sort is in progress. Deleting this can save a few more bytes of memory if needed.
7. Some BASICs cannot take a 'VAL' of a string with more than one blank, or of a null string. If yours is one of these, you will have to implement a subroutine to handle this.
8. While TDL and MITS BASICs format the results of a 'STR$' function with a leading blank, BASIC-E puts the blank after the string. The following function was written by Bruce Ratoff of the A.C.G.N.J. when he put the program up on BASIC-E.

```
DEF FNS$(X)=LEFT$(LEFT$(" ",-(X>=0))+STR$(X),LEN(STR$(ABS(X))))
```

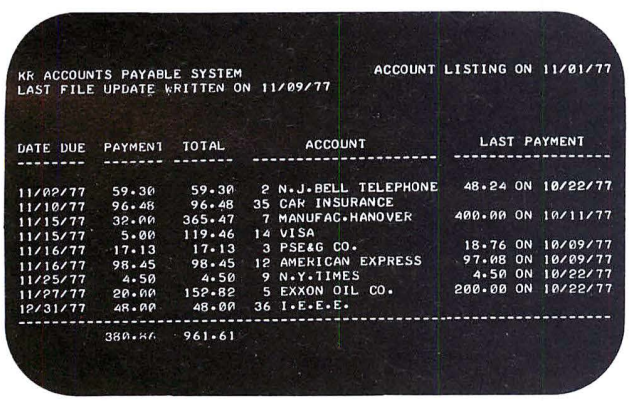
   This function will convert a given string to the proper format for it to be used correctly.
9. When using a cassette tape that cannot be stopped between records, a series of *nulls* must be inserted between each record in order to allow the BASIC interpreter to 'digest' each record as it is read in. If the next record were to begin being

played back before the next input statement were executed, that record would be lost. The routine at Line 4750 handles this, and should be set to punch enough fill characters for the file device in use.

10. In order to accommodate the use of hard copy devices as well as a CRT, the two listing commands check switch 0 on the IMSAI front panel. If the switch is down (0), the listing proceeds normally. If, however, the switch is up (1), the listing will be paginated, i.e., the listing will be broken into 11.5-inch pages (on an ASR-33), and lines will be printed at the top and bottom of the page for easy cutting of the forms.
11. When entering bills into the system, if the user answers the 'Account Number' question with a blank instead of a number, the program will assign a default number by taking the first unused number over 30. This is useful for one of a kind bills that will be deleted after they are paid; for example, a magazine subscription bill that only comes once a year.

The system has now been in use for over ten months, first as a cassette tape-based version, and later it was adapted to run on my iCOM discs. The program has proved to be a very valuable tool for household bookkeeping, and helps in controlling the personal budget. A side benefit that has resulted from using this type of automatic record keeping, is that the reports list the amount of interest being charged on each account. It quickly becomes apparent that certain accounts should be paid off before others. When one company charges 1.2% per month while another charges 1.5% per month, paying off the second as soon as possible can save money over the course of a year.

The program was recently entered in the software contest of the Amateur Computer Group of New Jersey (ACGNJ) where it won first place. Since several people began asking for copies for their own use, I decided to write this article to acquaint others with it. I hope you will find it as useful as I have.



```
KR ACCOUNTS PAYABLE SYSTEM                    ACCOUNT LISTING ON 11/01/77
LAST FILE UPDATE WRITTEN ON 11/09/77

DATE DUE  PAYMENT  TOTAL     ACCOUNT                  LAST PAYMENT
--------  -------  -------   ---------------------    ----------------

11/02/77    59.30    59.30   2 N.J.BELL TELEPHONE     48.24 ON 10/22/77
11/10/77    96.48    96.48  35 CAR INSURANCE
11/15/77    32.00   365.47   7 MANUFAC.HANOVER        400.00 ON 10/11/77
11/15/77     5.00   119.46  14 VISA
11/16/77    17.13    17.13   3 PSE&G CO.              18.76 ON 10/09/77
11/16/77    98.45    98.45  12 AMERICAN EXPRESS       97.08 ON 10/09/77
11/25/77     4.50     4.50   9 N.Y.TIMES               4.50 ON 10/22/77
11/27/77    20.00   152.82   5 EXXON OIL CO.          200.00 ON 10/22/77
12/31/77    48.00    48.00  36 I.E.E.E.
-------------------------------------------------------------------------
          380.86   961.61
```

Figure 4. Current Account Listing

```
100 REM *
150 REM *
200 REM *
250 REM *     ACCOUNTS PAYABLE SYSTEM
300 REM *        K.REDDEN JAN '77
350 REM *
400 REM *      VERSION 2.1    10/27/77
450 REM *
500 REM ****************************************
550 REM *
600 CLEAR 3000:REM  GIVE AS MUCH STRING SPACE AS POSSIBLE
650 DIM A$(50): DIM S$(99)
700 S$="                ": X3$="      "
750 AN=0: SN=0
800 GOSUB 18700
850 K$="KR ACCOUNTS PAYABLE SYSTEM      "
900 PRINT K$: PRINT: PRINT"TODAYS DATE IS ";: GOSUB 20650: D$=DA$
950 PRINT: GOSUB 18700
1000 DA$=D$: GOSUB 18900: D1$=DA$
1050 PRINT K$; TAB(45);"DATE: ";D1$: PRINT
1100 PRINT: PRINT: PRINT:PRINT"ALLOWABLE OPTIONS ARE:":PRINT
1150 PRINT"              L=LIST ACCOUNTS          LC=LIST CURRENT ACCOUNT"
1200 PRINT"              W=WRITE TAPE             R=READ TAPE"
1250 PRINT"              E=ENTER UPDATE           D=DELETE RECORD"
1300 PRINT"              S=SORT ON DUE DATE       SN=SORT BY ACC.#"
1350 PRINT"              PA=PRINT HISTORY OF      PS=PRINT HISTORY OF"
1400 PRINT"                 ALL ACCOUNTS             SELECTED ACCOUNT"
1450 PRINT"              P=PAY BILL               DO=DOODLE ON CRT"
1500 PRINT:PRINT:PRINT:PRINT:INPUT"ENTER OPTION";O$
1550 IF LEN(O$)<1 THEN 1800 ELSE O1$=LEFT$(O$,1): O2$=MID$(O$,2,1)
1600 IF ASC(O1$)>96 THEN O1$=CHR$(ASC(O1$) AND 223):REM CVT TO UPPER CAS
1650 IF LEN(O$)<2 THEN 1750
1700 IF ASC(O2$)>96 THEN O2$=CHR$(ASC(O2$) AND 223)
1750 O$=O1$+O2$
1800 IF O$="E" GOTO 6900
1850 IF O$="R" THEN 2450
1900 IF O$="W" THEN 4050
1950 IF O$="L" THEN LC=0: GOTO 4850
2000 IF O$="LC" THEN LC=1:GOTO 4850
2050 IF O$="P" THEN 9900
2100 IF O$="D" THEN 11400
2150 IF O$="SN" THEN 16300
2200 IF O$="S"  THEN 15150
2250 IF O$="PS" THEN 12550
2300 IF O$="PA" THEN 14650
2350 IF O$="DO"THEN GOTO 22410
2400 GOTO 950
2450 REM
2500 REM *************
2550 REM - THIS IS THE FILE READ SECTION ***********
2600 REM *************
2650 REM
2700 GOSUB 21200:REM  SET UP READER I/O VECTOR
2750 SWITCH
2800 NULL 0
2850 FOR I=1 TO 99
2900 INPUT S$(I)
2950 IF LEFT$(S$(I),1)<>"E" THEN NEXT
3000 REM  NOW DECODE FILE ENDER
3050 A$(0)=MID$(S$(I),4,3): S$(0)=MID$(S$(I),7,3): L$=MID$(S$(I),10,8)
3100 SN=I-1
3150 SWITCH
3200 GOSUB 21600
3250 REM  DO RECORDS READ IN = RECORDS LISTED IN ENDER?
3300 IF SN=VAL(S$(0)) +VAL(A$(0)) THEN 3550
3350 PRINT:PRINT"ERROR ON FILE READ."
3400 PRINT"FILE OF "L$" HAD "VAL(S$(0))+VAL(A$(0))" RECORDS."
3450 PRINT"ONLY "AN+SN" RECORDS READ IN.": GOTO 1500
3500 REM
3550 PRINT:PRINT"FILE OF "L$" READ OK."
3600 AN=VAL(A$(0)): SN=SN-AN
3650 FOR I=1 TO AN: A$(I)=S$(I): NEXT
3700 FOR I=1 TO SN: S$(I)=S$(I+AN): S$(I+AN)="": NEXT: S$(I+AN)=""
3750 FOR I=1 TO 50
3800 IF LEFT$(A$(I),1)<>"." THEN A$(I)=MID$(A$(I),2,LEN(A$(I))-1)
3850 NEXT
3900 GOTO 1500
3950 REM
4000 REM *************
4050 REM - THIS IS THE FILE WRITE SECTION ***********
4100 REM *************
4150 REM
4200 GOSUB 21850
4250 SWITCH
4300 GOSUB 4750
4350 IF AN>0 THEN FOR I=1 TO AN: GOSUB 4750: PRINT A$(I): NEXT
4400 IF SN>0 THEN FOR I=1 TO SN: GOSUB 4750: PRINT S$(I): NEXT
4450 GOSUB 4750: PRINT "END"
4500 PRINT RIGHT$(S$+STR$(AN),3)+RIGHT$(S$+STR$(SN),3)+D1$
4550 GOSUB 4750
4600 GOSUB 22300
4650 SWITCH
4700 GOTO 1500
4750 REM  THIS ROUTINE PUNCHES NULLS
4800 FOR I1=1 TO K: PRINT CHR$(0);:NEXT: RETURN
4850 REM
4900 REM *************
4950 REM - THIS IS THE FILE LIST SECTION ***********
5000 REM *************
5050 REM
5100 E=0: E1=0
5150 IF AN=0 THEN PRINT: PRINT"NO ACCOUNTS ON FILE.":PRINT:GOTO 1500
5200 LPRINT
5250 IF (INP(255) AND 1)=0 THEN 5400
5300 LPRINT TAB(15);:FOR I=1 TO 42:LPRINT"-";:NEXT:LPRINT:LPRINT
5350 N2=1
5400 LPRINT: LPRINT:GOSUB 18700
5450 LPRINT K$; TAB(44);"ACCOUNT LISTING ON ";D1$
5500 LPRINT"LAST FILE UPDATE WRITTEN ON "L$: LPRINT: LPRINT
5550 LPRINT: LPRINT"DATE DUE  PAYMENT  TOTAL ";
5600 LPRINT TAB(33)"ACCOUNT"; TAB(56);"LAST PAYMENT"
5650 LPRINT "--------  -------  -------";
5700 LPRINT "  ----------------------   ------------------":LPRINT
5750 FOR I=1 TO AN: GOSUB 17200
5800 IF LC=1 AND T3$=X3$ THEN 6300:REM  BRANCH IF CURRENT ACC.S ONLY
5850 IF T3$=X3$ THEN 5950
5900 DA$=T3$: GOSUB 18850: LPRINT DA$;
5950 LPRINT TAB(10);T4$; TAB(18);T5$; TAB(27);T1$;" ";T8$;
6000 GOSUB 19850: REM  LOCATE LAST HISTORY RECORD FOR THIS ACCOUNT
6050 IF LEN(S7$)=0 THEN 6200:REM  IF NO HIS-REC, DONT PRINT IT
6100 LPRINT TAB(53);S7$;" ON ";
6150 DA$=S4$: GOSUB 18850: LPRINT DA$;
6200 LPRINT: N2=N2+1
6250 E=E+VAL(T4$): E1=E1+VAL(T5$)
6300 NEXT
6350 FOR I=1 TO 71:LPRINT"-";:NEXT:LPRINT
6400 E$=STR$(E): E1$=STR$(E1)
6450 IF ASC(RIGHT$(E$,3))=46 THEN 6550
6500 IF ASC(RIGHT$(E$,2))=46 THEN E$=E$+"0" ELSE E$=E$+".00"
6550 IF ASC(RIGHT$(E1$,3))=46 THEN 6650
6600 IF ASC(RIGHT$(E1$,2))=46 THEN E1$=E1$+"0" ELSE E1$=E1$+".00"
6650 LPRINT TAB(10);RIGHT$(S$+E$,6); TAB(18);RIGHT$(S$+E1$,7)
6700 IF (INP(255)AND 1)=0 THEN 1500:REM  IF SW 1=1 THEN LINE FEED
6750 FOR I=N2 TO 56:LPRINT: NEXT
6800 LPRINT TAB(15);:FOR I=1 TO 42:LPRINT"-";:NEXT:LPRINT
6850 GOTO 1500
6900 REM
6950 REM *************
7000 REM - THIS IS THE BILL ENTRY SECTION ***********
7050 REM *************
7100 REM
7150 OLD=0: GOSUB 18700
7200 PRINT K$; TAB(45);"ACCOUNT UPDATE ROUTINE": PRINT
7250 GOSUB 19650
7300 IF N=0 THEN 8150: REM   IF 0 DEFAULT,THEN ASSIGN NEXT # >=30
7350 REM   NOW FIND OLD, OR ASSIGN NEW, ACCOUNT # & TITLE
7400 FOR I=1 TO AN
7450 GOSUB 17200
7500 T1=VAL(T1$)
7550 IF N<>T1 THEN NEXT
7600 IF N<>T1 THEN ?:PRINT"NEW ACCOUNT -  ENTER ACC.TITLE": GOTO 8500
7650 PRINT "ACCOUNT NUMBER ";N;" IS "T8$
7700 OLD=1: IF T3$=X3$ THEN 8600
7750 REM  IF OLD BILL WAS NOT PAID,BUILD HISTORY-RECORD FOR IT
7800 S1$=T1$: S2$=T2$: S3$=T3$
```

```
7850 S4$=LEFT$(S$,5)
7900 S5$=T4$: S6$=T5$: S7$=LEFT$(S$,6)
7950 S8$=T6$
8000 SN=SN+1: K=SN: GOSUB 18400:REM  STORE THE RECORD
8050 GOSUB 19100
8100 GOTO 8600
8150 REM   THIS SECTION ASSIGNS A DEFAULT ACC #
8200 V2=0: FOR I=1 TO AN
8250 V1=VAL(MID$(A$(I),2,2))
8300 IF V1>=V2 THEN V2=V1
8350 NEXT
8400 IF V2<30 THEN N=30 ELSE N=V2+1
8450 PRINT:PRINT"DEFAULT ACC.#";N;" ASSIGNED. ENTER ";
8500 INPUT "ACCOUNT NAME ";T8$: REM
8550 IF LEN(T8$)>20 THEN T8$=LEFT$(T8$,20)
8600 PRINT "DATE PAYMENT IS DUE ";: GOSUB 20650: T3$=DA$
8650 INPUT "TOTAL AMOUNT DUE (MAX 7) ";T5$
8700 IF LEN(T5$)<=7 THEN 8800
8750 PRINT:PRINT"MAXIMUM NUMBER IS 9999.99  REENTER AMOUNT":GOTO 8650
8800 T5$=RIGHT$(S$+T5$,7)
8850 INPUT "PAYMENT AMOUNT DUE ";T4$
8900 IF LEN(T4$)=0 THEN T4$=RIGHT$(T5$,6) ELSE T4$=RIGHT$(S$+T4$,6)
8950 INPUT "INTEREST CHARGE ";T6$
9000 T6$=RIGHT$(S$+T6$,5)
9050 PRINT"DATE BILL WAS RECEIVED ";: GOSUB 20650
9100 IF DA$<>A3$ THEN T2$=DA$ ELSE T2$=RIGHT$(S$+D$,5)
9150 T1$=RIGHT$(STR$(N),2)
9200 REM
9250 REM   NOW DISPLAY SUMMARY & CONFIRM ENTRY
9300 GOSUB 18700
9350 PRINT"ACCOUNT # ";T1$;" - ";T8$
9400 PRINT: PRINT"PAYMENT OF $";T4$;" DUE ON ";
9450 DA$=T3$: GOSUB 18850: PRINT DA$;
9500 PRINT TAB(40); "TOTAL DUE $";T5$
9550 PRINT "FINANCE CHARGE $";T6$
9600 PRINT:INPUT"ACCEPT UPDATE ";N$
9650 IF LEFT$(N$,1)<>"Y" THEN PRINT"REJECTED":PRINT:GOTO 9850
9700 PRINT: PRINT"ACCOUNT FILE UPDATED."
9750 IF OLD=0 THEN AN=AN+1: I=AN
9800 GOSUB 18250
9850 GOTO 1500
9900 REM
9950 REM *************
10000 REM - THIS IS THE BILL PAYING SECTION ***************
10050 REM *************
10100 REM
10150 GOSUB 19650
10200 FOR I=1 TO AN
10250 GOSUB 17200
10300 T1=VAL(T1$)
10350 IF N<>T1 THEN NEXT
10400 IF N<>T1 THEN PRINT"ACCOUNT # ";N;" NOT ON FILE.":GOTO 1500
10450 PRINT:PRINT T8$
10500 PRINT"PAYMENT AMOUNT - ";T4$;"      DUE ON ";
10550 DA$=T3$:GOSUB 18850: PRINT DA$
10600 PRINT "TOTAL   AMOUNT - ";T5$
10650 PRINT:INPUT"AMOUNT TO BE PAID ";D2$
10700 IF VAL(D2$)=0 THEN 11350:REM  IF 0 ENTERED, DO NOT UPDATE
10750 S1$=T1$:  S2$=T2$:  S3$=T3$
10800 S4$=RIGHT$(S$+D$,5)
10850 S5$=T4$: S6$=T5$: S7$=RIGHT$(S$+D2$,6)
10900 S8$=T6$
10950 T2$=LEFT$(S$,5)
11000 T3$=LEFT$(S$,5)
11050 T4$=LEFT$(S$,6):REM CLEAR PAY DUE DATA
11100 T5$=RIGHT$(S$+STR$(VAL(T5$)-VAL(D2$)),7)
11150 T6$=LEFT$(S$,5)
11200 GOSUB 18250:REM   UPDATE THE CURRENT-RECORD
11250 SN=SN+1: K=SN: GOSUB 18400:REM   UPDATE THE HISTORY-RECORD
11300 GOSUB 19100:REM  NOW SORT THE HIS-REC FILE
11350 GOTO 1500:REM  RETURN FOR NEXT OPTION
11400 REM
11450 REM *************
11500 REM - THIS IS THE RECORD DELETE SECTION **********
11550 REM *************
11600 REM
11650 GOSUB 19650
11700 FOR I=1 TO AN
11750 GOSUB 17200
11800 T1=VAL(T1$)
11850 IF N<>T1 THEN NEXT
11900 IF N<>T1 THEN PRINT"ACCOUNT # ";N;" NOT ON FILE.":GOTO 1500
11950 PRINT:PRINT"ACCOUNT # ";N;" IS ";T8$
12000 INPUT"DELETE ";N$
12050 IF LEFT$(N$,1)<>"Y" THEN 1500
12100 FOR I1=I TO AN
12150 A$(I1)=A$(I1+1): NEXT
12200 AN=AN-1
12250 IF SN=0 THEN 1500:FOR K=1 TO SN:REM  NOW DELETE ANY HISTORY-RECORDS
12300 GOSUB 17700: IF N<>VAL(S1$) THEN NEXT: GOTO 1500
12350 IF K=SN THEN 12400:FOR I=K TO SN-1: S$(I)=S$(I+1): NEXT
12400 SN=SN-1: GOTO 12250
12450 REM
12500 REM *************
12550 REM - THIS IS THE PRINT SELECTED ACCOUNT ROUTINE ******
12600 REM *************
12650 REM
12700 GOSUB 18700
12750 PRINT K$; TAB(40);"SELECTED ACCOUNT HISTORY PRINTER":PRINT
12800 GOSUB 19650
12850 FOR I=1 TO AN: GOSUB 17200:REM  FIND THE ACC.RECORD
12900 T1=VAL(T1$)
12950 IF N<>T1 THEN NEXT
13000 IF N<>T1 THEN PRINT"ACCOUNT # ";N;" NOT ON FILE.":GOTO 1500
13050 GOSUB 13150:REM   CALL THE PRINT ROUTINE
13100 GOTO 1500
13150 LPRINT:LPRINT"ACCOUNT # ";T1$
13200 LPRINT"ACCOUNT TITLE - ";T8$:LPRINT
13250 GOSUB 13900:REM  PRINT COL HEADERS
13300 REM   NOW GET HISTORY-RECORDS & PRINT
13350 FOR K=1 TO SN
13400 IF T1<>VAL(MID$(S$(K),2,2)) THEN 13550
13450 GOSUB 17700:REM   FORMAT THE RECORD
13500 GOSUB 14200
13550 NEXT
13600 IF VAL(T5$)=0 THEN RETURN
13650 DA$=T2$:GOSUB 18850: LPRINT DA$;
13700 DA$=T3$:GOSUB 18850: LPRINT TAB(10); DA$;
13750 LPRINT TAB(20);T4$; TAB(31);T6$; TAB(40);T5$
13800 RETURN
13850 REM
13900 REM   THIS PRINTS THE COLUME HEADINGS ****
13950 LPRINT:LPRINT"DATE REC  DATE DUE  PAYMENT  INTEREST    TOTAL";
14000 LPRINT"   DATE PAID  AMOUNT PAID"
14050 LPRINT"--------  --------  -------  --------   -------";
14100 LPRINT"  ---------  -----------": RETURN
14150 REM
14200 REM   THIS PRINTS THE COLUMES OF DATA ****
14250 DA$=S2$: GOSUB 18850: LPRINT DA$;
14300 DA$=S3$: GOSUB 18850: LPRINT TAB(10);DA$;
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```
14350 LPRINT TAB(20);S5$; TAB(31);S8$; TAB(40);S6$;
14400 DA$=S4$: GOSUB 18850: LPRINT TAB(50);DA$;
14450 LPRINT TAB(63);S7$
14500 RETURN
14550 REM
14600 REM *************
14650 REM - THIS IS THE PRINT HISTORY OF ALL ACCOUNTS ROUTINE ****
14700 REM *************
14750 REM
14800 FOR I=1 TO AN: GOSUB 17200:REM  FIND THE ACC.RECORD
14850 T1=VAL(T1$): GOSUB 13150
14900 LPRINT:LPRINT:LPRINT
14950 NEXT
15000 GOTO 1500
15050 REM
15100 REM *************
15150 REM - THIS IS THE 'SORT ON DUE DATE' ROUTINE *********
15200 REM *************
15250 REM
15300 PRINT"SORT IN PROGRESS"
15350 TE=AN
15400 FOR I1=1 TO AN-1: TF=0:  FOR I=1 TO TE-1
15450 REM    BUBBLE SORT BY YEAR, MONTH & DAY
15500 X1$=MID$(A$(I),9,5): X2$=MID$(A$(I+1),9,5)
15550 IF X1$=X3$ AND X2$=X3$ THEN 15950
15600 IF X1$=X3$ THEN 15900 ELSE IF X2$=X3$ THEN 15950
15650 V1=VAL(MID$(A$(I),13,1)): V2=VAL(MID$(A$(I+1),13,1))
15700 IF V1>V2 THEN 15900 ELSE IF V1<V2 THEN 15950
15750 V1=VAL(MID$(A$(I),9,2)): V2=VAL(MID$(A$(I+1),9,2))
15800 IF V1>V2 THEN 15900 ELSE IF V1<V2 THEN 15950
15850 IF VAL(MID$(A$(I),11,2))<= VAL(MID$(A$(I+1),11,2)) THEN 15950
15900 TEMP$=A$(I): A$(I)=A$(I+1): A$(I+1)=TEMP$: TF=1
15950 N3$=MID$(A$(I),32,1): IF LEN(N3$)=0 THEN  16050
16000 OUT 255,NOT(ASC(N3$)+ 16*ASC(N3$)) AND 255:REM  FLASH LIGHTS
16050 NEXT I: IF TF<0 THEN 16150
16100 TE=TE-1: NEXT I1
16150 GOSUB 16700
16200 PRINT"SORT FINISHED": GOTO 1500
16250 REM
16300 REM ***************
16350 REM - THIS IS THE 'SORT BY ACC. NUMBER SUBROUTINE *******
16400 REM ***************
16450 REM
16500 PRINT"SORT IN PROGRESS"
16550 TE=AN
16600 FOR I1=1 TO AN-1: TF=0: FOR I=1 TO TE-1
16650 IF VAL(MID$(A$(I),2,2))<=VAL(MID$(A$(I+1),2,2)) THEN 16750
16700 TEMP$=A$(I): A$(I)=A$(I+1): A$(I+1)=TEMP$: TF=1
16750 N3$=MID$(A$(I),32,1): IF LEN(N3$)=0 THEN 16850
16800 OUT 255,NOT(ASC(N3$)+16*ASC(N3$)) AND 255:REM  FLASH LIGHTS
16850 NEXT I: IF TF=0 THEN 16950
16900 TE=TE-1: NEXT I1
16950 GOSUB 18900:PRINT"SORT FINISHED":PRINT: GOTO 1500
17000 REM
17050 REM
17100 REM ***************SYSTEM SUBROUTINES***************
17150 REM
17200 REM - THIS IS THE CURRENT-RECORD FORMATTER SUBROUTINE ****
17210 REM
17250 T1$=MID$(A$(I),2,2): REM  ACCOUNT NUMBER
17300 T2$=MID$(A$(I),4,5):REM    DATE ENTERED
17350 T3$=MID$(A$(I),9,5):REM    PAYMENT DUE DATE
17400 T4$=MID$(A$(I),14,6):REM   PAYMENT AMOUNT
17450 T5$=MID$(A$(I),20,7):REM   TOTAL AMOUNT
17500 T6$=MID$(A$(I),27,5):REM   INTEREST CHARGE
17550 T8$=MID$(A$(I),32,20):REM  ACCOUNT NAME
17600 RETURN
17650 REM
17700 REM   THIS IS THE HISTORY-RECORD FORMATTER SUBROUTINE ****
17750 S1$=MID$(S$(K),2,2):REM    ACCOUNT NUMBER
17800 S2$=MID$(S$(K),4,5):REM    BILL ENTERED DATE
17850 S3$=MID$(S$(K),9,5):REM    BILL DUE DATE
17900 S4$=MID$(S$(K),14,5):REM   BILL PAID DATE
17950 S5$=MID$(S$(K),19,6):REM   PAYMENT DUE AMOUNT
18000 S6$=MID$(S$(K),25,7):REM   TOTAL DUE AMOUNT
18050 S7$=MID$(S$(K),32,6):REM   ACTUAL AMOUNT PAID
18100 S8$=MID$(S$(K),38,5):REM   INTEREST CHARGE
18150 RETURN
18200 REM
18250 REM - THIS IS THE CURRENT-RECORD BUILDER SUBROUTINE ****
18300 A$(I)=","+T1$+T2$+T3$+T4$+T5$+T6$+T8$: RETURN
18350 REM
18400 REM   THIS IS THE HISTORY-RECORD BUILDER SUBROUTINE ****
18450 S$(K)="1"+S1$+S2$+S3$+S4$+S5$+S6$+S7$+S8$: RETURN
18500 REM
18550 REM   THIS IS THE HISTORY-RECORD DUMMY ****
18600 S1$="": S2$="": S3$="": S4$=""
18650 S5$="": S6$="": S7$="": S8$="": RETURN
18700 REM
18750 REM - THIS IS THE CRT FORM FEED/DELAY SUBROUTINE ****
18800 PRINT:PRINT CHR$(26)::J=TAN(9): RETURN
18850 REM
18900 REM THIS SUBROUTINE FORMATS A DATE STRING TO MM/DD/YY ****
18950 IF LEN(DA$)<>5 OR DA$=X3$ THEN DA$="          ": RETURN
19000 DA$=LEFT$(DA$,2)+"/"+MID$(DA$,3,2)+"/"+RIGHT$(DA$,1)
19050 RETURN
19100 REM
19150 REM  THIS IS THE SORT OF THE HISTORY-RECORD FILE *****
19200 IF SN<2 THEN RETURN ELSE TE=SN
19250 FOR K1=1 TO SN-1: TF=0:  FOR K=1 TO TE-1
19300 IF VAL(MID$(S$(K),2,2))<=VAL(MID$(S$(K+1),2,2)) THEN 19400
19350 TEMP$=S$(K):  S$(K)=S$(K+1):  S$(K+1)=TEMP$: TF=1
19400 NEXT K: IF TF=0 THEN 19550
19450 TE=TE-1: NEXT K1
19500 LPRINT:LPRINT"DATE RECEIVED  DATE DUE  INSTALMENT    TOTAL";
19550 RETURN
19600 REM
19650 REM   THIS SUBROUTINE GETS AN ACCOUNT NO. FROM THE KEYBOARD ****
19700 INPUT "ACCOUNT NUMBER ";N
19750 IF (N>100 OR N<0) THEN PRINT "INVALID NUMBER":GOTO 19700
19800 RETURN
19850 REM
19900 REM   THIS SUBROUTINE FINDS THE LAST HISTORY-RECORD FOR ****
19950 REM  ACCOUNT NO. T1$, THAT WAS ACTUALLY PAID.
20000 TF=0: FOR K=1 TO SN
20050 IF VAL(T1$) <> VAL(MID$(S$(K),2,2)) THEN 20450
20100 IF K=SN THEN 20350:REM  HANDLE LAST RECORD
20150 IF MID$(S$(K),2,2) = MID$(S$(K+1),2,2) THEN TF=TF+1:GOTO 20450
20200 TF=TF+1:REM   # OF RECORDS FOR THIS ACC #
20250 IF VAL(MID$(S$(K),32,6))<>0 THEN 20350
20300 K=K-1: TF=TF-1: IF TF>0 THEN 20250 ELSE 20500
20350 GOSUB 17650:REM   RECORD FOUND, FORMAT IT
20400 RETURN
20450 NEXT
20500 GOSUB 18500:REM   RECORD NOT FOUND, ZERO RETURN
20550 RETURN
20600 REM
20650 REM - THIS SUBROUTINE INPUTS A DATE FROM THE KB *******
20700 INPUT DA$: IF LEN(DA$)=0 THEN DA$="      ":RETURN
20750 IF LEN(DA$)<>8 THEN 21100
20800 IF MID$(DA$,3,1)<>"/" OR MID$(DA$,6,1)<>"/" THEN 21100
20850 A=VAL(LEFT$(DA$,2)):  IF A<1 OR A>12 THEN 21100
20900 A=VAL(MID$(DA$,4,2)):  IF A<1 OR A>31 THEN 21100
20950 A=VAL(RIGHT$(DA$,2)): IF A<70 OR A>90 THEN 21100
21000 DA$=LEFT$(DA$,2)+MID$(DA$,4,2)+RIGHT$(DA$,1): RETURN
21050 REM
21100 PRINT"DATE MUST BE ENTERED AS MM/DD/YY ";: GOTO 20700
21150 REM
21160 REM *****
21200 REM  THIS SUBROUTINE SETS I/O VECTORS FOR FILE READS *****
21210 REM *****
21250 REM IF SW 1 IS UP, USE TTY
21300 IF (INP(255)AND 1)=1 THEN RETURN
21350 REM  SET BASIC CI=8706
21360 REM  THE FILE IS READ BY SETTING BASICS CI TO POINT TO
21365 REM  THE FILE READ DRIVER. WHEN THE READ IS DONE, RESET
21366 REM  THE POINTERS TO NORMAL.
21400 R1=519: REM  ADDRESS OF BASIC CI VECTOR
21450 R2=06: R3=135: REM 8706 (ZAPPLE RI)
21500 POKE R1,R2: POKE R1+1,R3: POKE R1+5,201
21550 RETURN
21600 REM  RESTORE VECTORS
21650 POKE R1,3: POKE R1+1,135: POKE R1+5,195:REM 8706
21700 RETURN
21750 REM
21800 REM  THIS SUBROUTINE SET I/O VECTORS FOR FILE WRITES *****
21850 REM  IF SW 1 IS UP, USE TTY
21900 K=10: IF (INP(255) AND 1)=1 THEN RETURN
21950 REM  SET APPLE MONITOR I/O VECTORS FOR CO=PUNCH OUT
22000 R1=34570:REM  ADDRESS OF ZAPPLE CO I/O VECTOR
22050 R2=PEEK(R1): R3=PEEK(R1+1):REM  SAVE OLD VECTORS
22100 R5=12: R6=135:REM HEX 0C 87
22150 POKE R1,R5: POKE R1+1,R6
22200 K=50: RETURN
22250 REM
22300 IF (INP(255)AND 1)=1 THEN RETURN:REM  IF TTY,RETURN
22350 POKE R1,R2: POKE R1+1,R3:RETURN
22400 REM
22410 REM  - ADM-3A CRT DOODLE SUBROUTINE *******
22450 N=1000: PRINT CHR$(26)
22500 I1=INP(1)
22550 FOR I=1 TO N
22600 PRINT CHR$(27)"="CHR$(31+RND(1)*24)CHR$(31+71*RND(1))"*";
22650 IF I/20 = INT(I/20) THEN PRINT
22700 IF INP(1)<>I1 THEN 950:REM  END ON KEYBOARD INPUT
22750 NEXT: GOTO 22450
22800 REMEND
```


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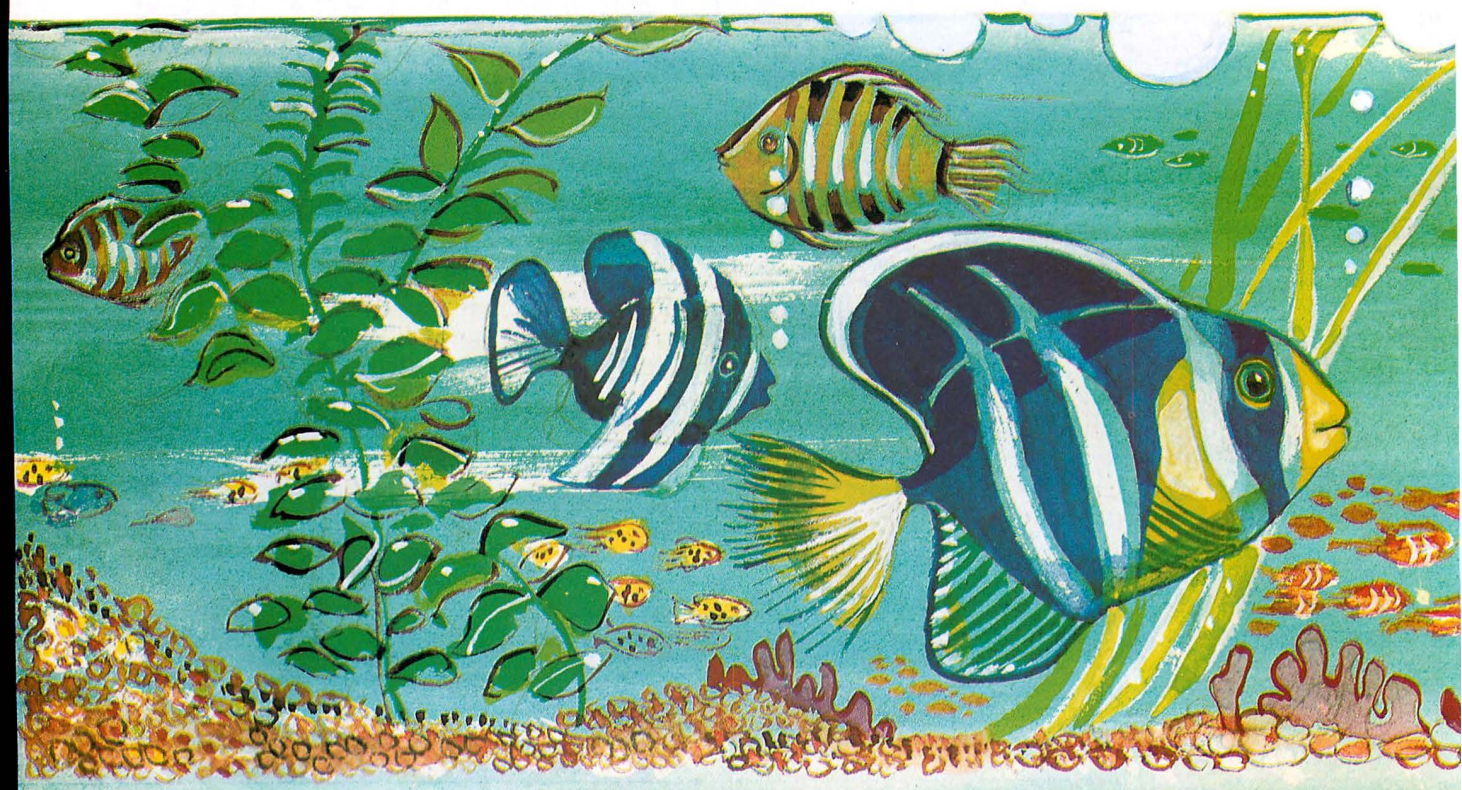


Aquarium

By Timothy O'Shaughnessy

To successfully maintain a marine (salt water) aquarium, the physical conditions within the tank must remain within certain limits. Without external control some of these conditions will eventually fall outside the acceptable limits. To control the environment of the aquarium, measurements must be periodically taken. Based on the data obtained, the observer takes corrective action. This guarantees the tank parameters remain acceptable.

Many books have been published on the proper maintenance of the aquarium. Therefore, the details of maintenance shall not be reported in this article. However, it is possible to use the computer to measure the tank parameters, to calculate and to perform the necessary corrections.

The conventional tests are often difficult to perform. Therefore, only one (often inaccurate) sample is obtained for each parameter. These tests often require human judgement to obtain a numerical value. For an example let the nominal value of salinity be 35 grams/liter (often expressed as 35°/oo). To "measure" salinity a hydrometer is used. This device floats in the water, and determines the density (weight) of the water. However, the density of the water is a function of the salinity and temperature. If the reading of the hydrometer is 1.025, it is often interpreted that the salinity is 35 grams/liter. However, this is only correct if the water temperature is near 77°F. At 66°F the 1.025 reading corresponds to 33 grams/liter. Therefore, the low salinity of 33 grams/liter is incorrectly interpreted as a nominal 35 grams/liter. An additional problem with the hydrometer is that bubbles often accumulate on its surface which causes an inaccurate reading.

The computer offers many advantages. With the proper interface and program we obtain:

1. Impartial measurements
2. Large number of samples
3. Statistical data reduction
4. Automatic calibration
5. Error control

Items 2 and 3 are the primary advantages. The computer is programmed to reject noise measurements. The

Maintenance

subroutine at 4500 in the example program calculates an average based on "N" samples. The maximum variation in the data is controlled by the parameter "E." If the noise or uncertainty is excessive, the program is terminated. The computer is programmed to calibrate itself. Failure to achieve a specified accuracy terminates the program.

It shall be noted that the circuit shown by Figure 1 permits any combination of 8 independent measurements and outputs. If decoding is used, 256 combinations of independent measurements or output functions are available.

The following list provides measurements that can be performed by the computer with the proper interface. Some of these measurements require special probes and amplifiers that are commercially available.

Temperature
Conductivity
pH
Salinity
Specific Gravity
Ammonia Concentration
Nitrate Concentration
Copper
Cyanide
Lead
Cadmium

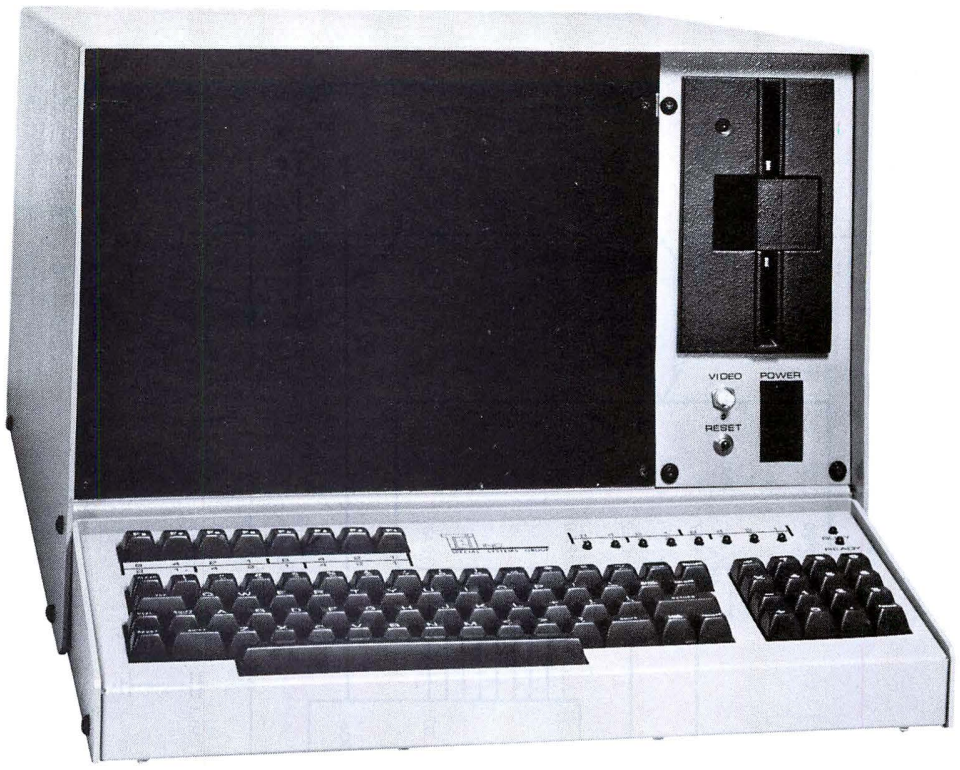
The example program is used to measure three parameters (temperature, salinity, and pH). Salinity and pH require special probes and additional circuitry. Five analog switches are required. One is needed for calibration, and two probes are for determining relative salinity.

After all measurements have been completed, the program determines the parameters that need correcting. For example if the pH is too low (pH < 8.0) a pulse is provided to add pH buffer. Corrections that need a human interface are printed onto the terminal.

Figure 2 shows how a piecewise linear relationship was obtained for the thermister. Since the A/D converter has an attenuator that sets each bit to -10 millivolts, the mercury cell (1.35 volts) should be seen by the computer as 135.

—16253 to —16256 are the memory locations of the PIA.

```
100 N=30
110 GOSUB 4000
120 PRINT"AQUARIUM MAINTANENCE"
130 N=6
140 GOSUB 4000
150 DIM A$(8),K$(8)
160 GOSUB 2900
190 PRINT"PERFORM MAINTANENCE?"
200 GOSUB 4100
210 IF A$="YES" THEN 230
220 GOTO 5000
230 PRINT"ENTER PASSWORD."
240 GOSUB 4110
250 IF A$=K$ THEN 290
260 GOTO 4950
290 PRINT"VERIFY THAT THE PROBES"
300 PRINT"ARE IMMERSED IN THE SAMPLE."
310 DIM D1$(8)
320 D1$=A$
330 PRINT"PRESS RETURN KEY TO CONTINUE."
340 INPUT A$
350 REM:  CAUTION!  PH VALVE MUST
360 REM:  IGNORE A NARROW PULSE ON PB7.
370 POKE -16253,0
380 POKE -16254,255
390 POKE -16253,4
400 POKE -16254,254
410 POKE -16255,44
420 GOSUB 4900
430 REM:  **AUTO CALIBRATION**
460 X=PEEK(-16254)
470 IF X=254 THEN 490
480 GOTO 4200
490 N=10
500 E=20
510 GOSUB 4500
520 E=ABS(135-A)
530 IF E<7 THEN 560
540 PRINT"CALIBRATION ERROR!"
550 GOTO 5010
560 E1=(100*E)/135
570 E2=(100*E) MOD 135
580 PRINT"ERROR = ";E1;".";100*E2/135;"%"
590 C=A
600 REM:  TEMPERATURE
610 POKE -16254,253
620 GOSUB 4900
630 E=20
640 N=10
650 GOSUB 4500
660 T=(A*10-84)/18
670 PRINT"TEMP.=";T;" F"
680 PRINT"TEMP.=";5*(T-32)/9
700 REM:  SALINITY
710 POKE -16254,251
720 GOSUB 4900
730 E=20
740 N=10
750 GOSUB 4500
760 S1=A
780 POKE -16254,247
790 GOSUB 4900
800 E=20
810 N=10
820 GOSUB 4500
830 S2=A
840 IF (S2-S1)>10 THEN 900
850 IF (S2-S1)<10 THEN 880
860 PRINT"SALINITY OK"
870 GOTO 910
880 PRINT"SALINITY TOO HIGH!"
890 GOTO 910
900 PRINT"SALINITY TOO LOW!"
910 PRINT"SREF=";S1
920 PRINT"STNK=";S2
930 PRINT"MAX. DIFF.=10"
940 REM:  PH, H ION PROBE AND BUFFER AMP
950 POKE -16254,239
960 GOSUB 4900
970 E=20
980 N=10
990 GOSUB 4500
1000 P1=7+A/10
1010 P2=AMOD10
1020 PRINT"PH = ";P1;".";P2
1200 REM:  USER DEFINED CORRECTION ALGORITHEMS
1210 REM:  ARE INSERTED BETWEEN LINES 1400 & 2800.
1400 REM:  PH CORRECTION
1410 IF P1<8 THEN 1430
1420 GOTO 5010
1430 POKE -16254,127
1440 FOR I=1 TO 2000
1450 NEXT I
1460 POKE -16254,255
1470 PRINT"PH BUFFER ADDED!"
1480 GOTO 5010
2900 REM:  PASSWORD
2910 K$="PASSWORD"
2920 RETURN
4000 FOR I= 1 TO N
4010 PRINT
4020 NEXT I
4030 RETURN
4100 PRINT"ENTER:  YES  OR  NO"
4110 INPUT A$
4120 RETURN
4200 N=30
4210 GOSUB 4000
4220 PRINT"FATAL ERROR!"
4230 N=6
4240 GOSUB 4000
4250 PRINT"TURN OFF COMPUTER & THEN"
4260 PRINT"CONNECT THE INSTRUMENT"
4270 PRINT"PACKAGE."
4280 GOSUB 4000
4290 GOTO 5010
4500 REM:  MEASUREMENT ROUTINE
4510 REM:  D = 1 DUMMY READ
4520 D=PEEK(-16256)
4530 A=0
4540 V0=PEEK(-16256)
4550 FOR I=1 TO N
4560 V=PEEK(-16256)
4570 A=A+V
4580 IF ABS(V-V0)<E THEN 4610
4590 PRINT"NOISY MEASUREMENT!"
4600 GOTO 5010
4610 NEXT I
4620 A=A/N
4630 RETURN
4900 PRINT"WAIT!"
4910 FOR I=1 TO 5000
4920 NEXT I
4930 RETURN
4950 PRINT"ACCESS DENIED!"
4960 GOTO 5020
5000 PRINT"NO ACCESS REQUESTED"
5010 PRINT"END"
5020 END
```

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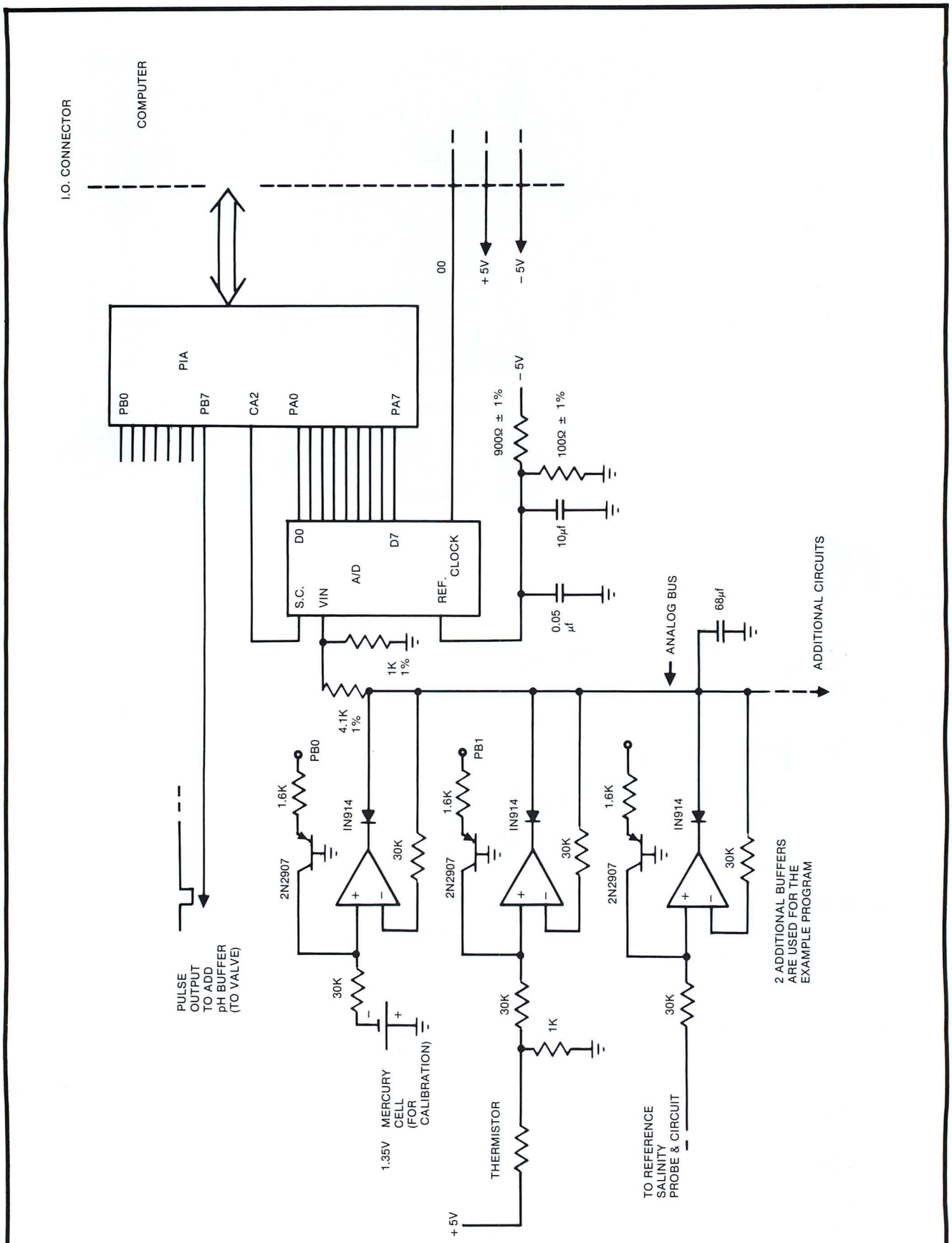

I.O. CONNECTOR
COMPUTER
PIA
PB0
PB7
CA2
PA0
PA7
00
+5V
-5V
900Ω ± 1%
100Ω ± 1%
10μf
0.05 μf
D0
D7
A/D
S.C.
VIN
REF.
CLOCK
1K 1%
4.1K 1%
ANALOG BUS
68μf
ADDITIONAL CIRCUITS
PB0
PB1
1.6K
IN914
2N2907
30K
1K
PULSE OUTPUT TO ADD pH BUFFER (TO VALVE)
1.35V MERCURY CELL (FOR CALIBRATION)
THERMISTOR
TO REFERENCE SALINITY PROBE & CIRCUIT
2 ADDITIONAL BUFFERS ARE USED FOR THE EXAMPLE PROGRAM

Figure 1

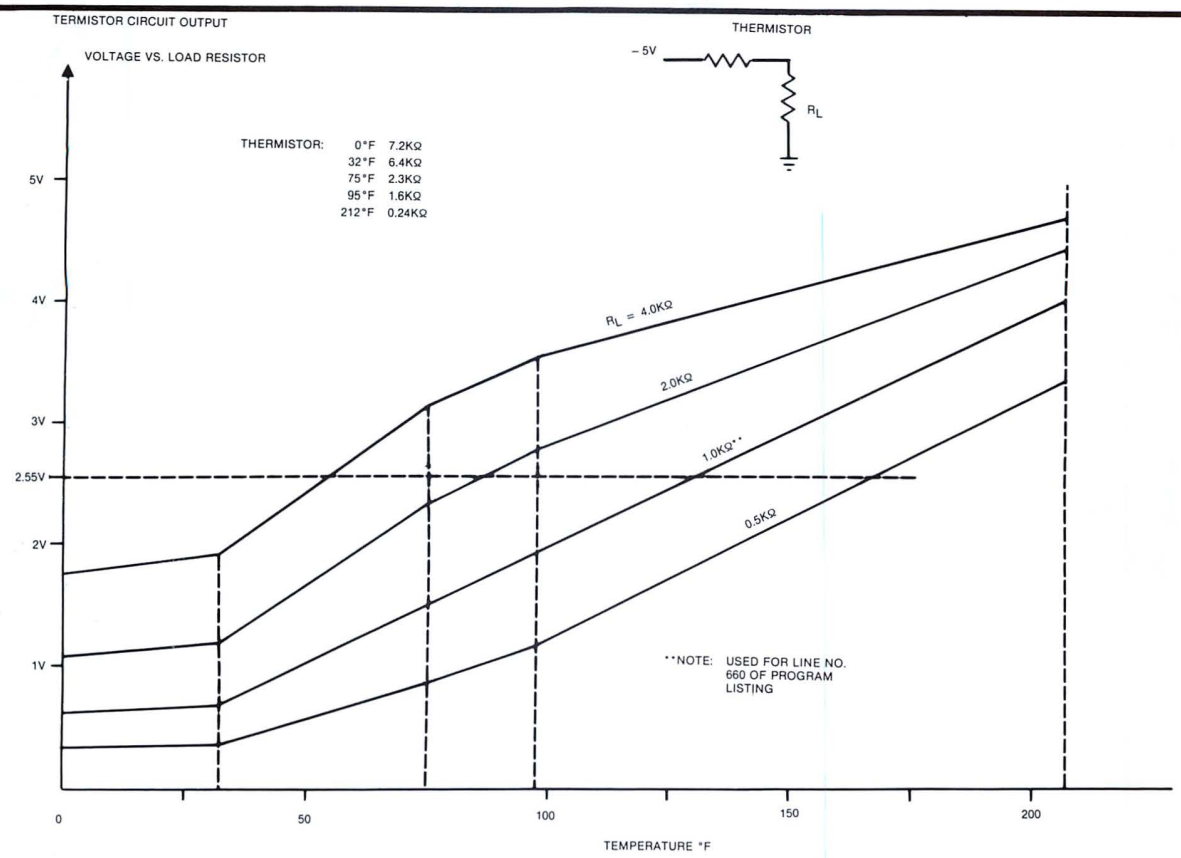
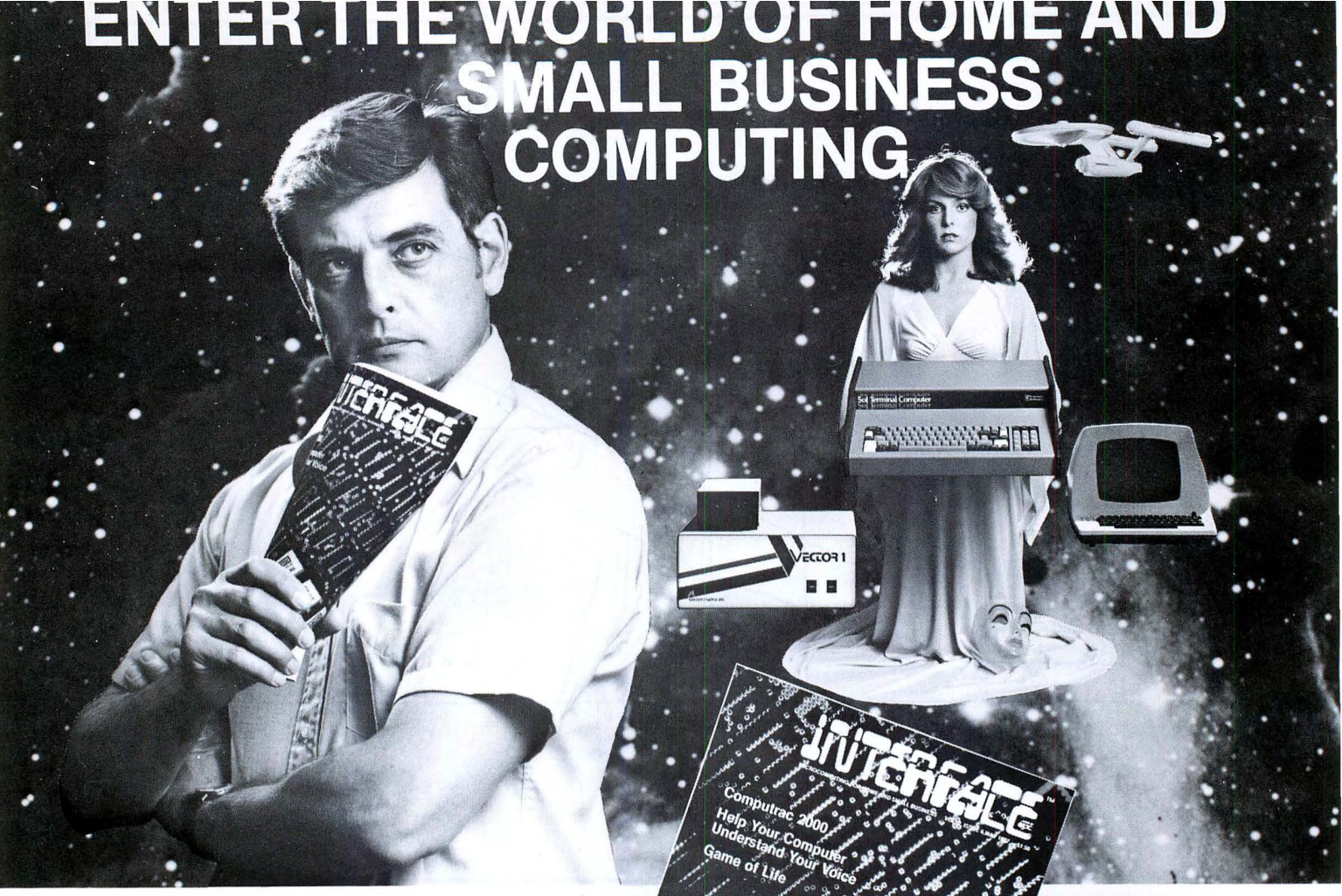


Figure 2.



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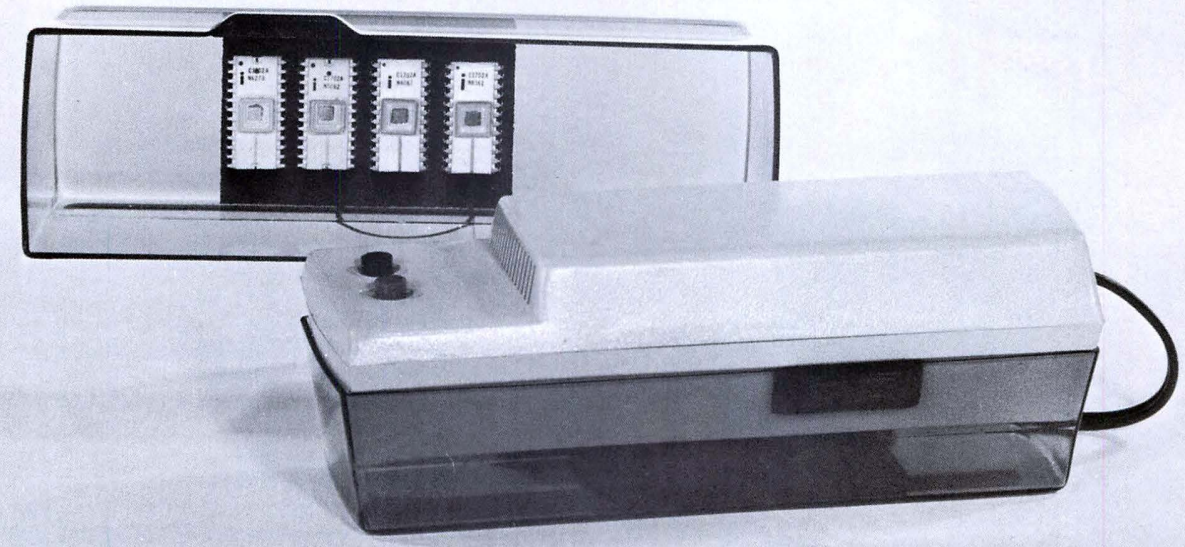

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The Pocket

by David Chapman

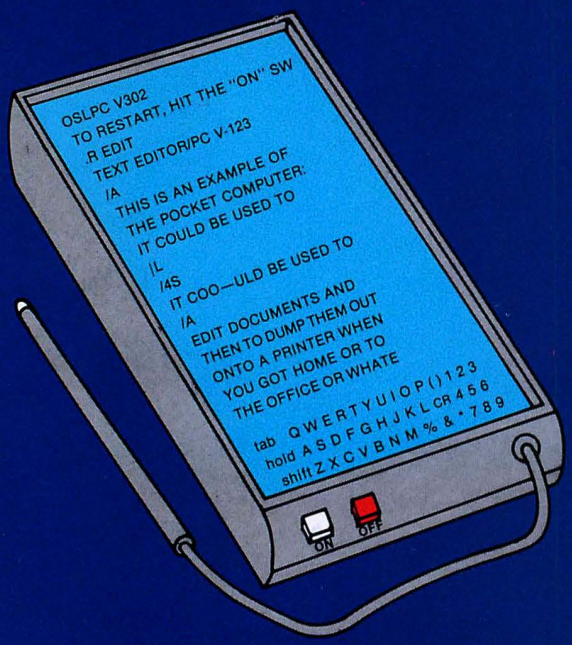

Figure 1. The Pocket Computer, an early model. Note "pseudo-keyboard."

Computers get smaller all the time; but it seems that there is a downward quantum jump in physical size that occurs near the beginning of each decade. First there were the mechanical analog monstrosities of the Forties, then the tube and relay kluges of the Fifties, the transistor and SSI systems of the Sixties, and now the LSI microcomputers in the Seventies. What's next?

Certainly further miniaturization would be desirable. The microcomputer, though relatively small, is far from portable by the time you add memory and peripherals to it. It can not be carried around the way a pocket calculator can, which severely limits the times and places it can be used. The difference between a hypothetical pocket computer and the micro is like the difference between a modern calculator and an adding machine: one is of universal utility; the other is restricted in use to a small group, "a computer in every home" notwithstanding. To bring the computer to the people, I suggest a computer in every pocket!

Let us now look at how a pocket computer might be made commercially practical. The main restriction on the miniaturization of the microcomputer is no longer the CPU itself, nor even the memory, but rather the I/O devices, particularly the keyboard and the CRT, the only tube in the IC age. This limitation can be overcome with technology available now — although the development time will probably delay the introduction of the pocket computer until the early 1980s.

The pocket computer, as I visualize it, would be similar in size and shape to the pocket calculator, a time- and consumer-tested design, about six inches long, four inches wide, and three eights of an inch deep, with a plastic case and simple instructions on the back.

The general design philosophy should be to make it instantly usable to anyone who can read and write. Instead of a keyboard and seven segment readouts, the entire front would be covered with a flat LED, liquid crystal, or plasma screen, like the ones on PLATO terminals. Prototypes of all these designs have been in existence for several years since they were developed by the television manufacturers as possible substitutes for the CRT. This screen would probably be the most expensive single item in the computer, not including software. At first, low definition black-and-colored versions with perhaps 256x256 dots would appear; then as prices drop and the technology improves, full color, multi-intensity screens might become available, with definition as high as $1K^2$.

The screen would undoubtedly consume a large amount of current, which would necessitate large storage batteries; but as the inside of the box would probably be otherwise largely empty, this should cause no problem.

The processor, memory, and interfaces would be on a chip or chips glued to the back of the screen. A possibility is to make the chips plug into each other in some way so that one could add a new 32K memory chip or a line printer interface to one's existing system. A

Computer

minimum configuration, which would come on a single chip, might include, say, a 16-bit microprocessor with BASIC, APL, and TRAC on ROM, perhaps with an assembler/text editor/linking loader and a USR or similar machine language subroutine call to allow special routines that are not possible in the high-level languages; 32Kx16 RAM for program and data storage; screen, lightpen; and interfaces to disc drives, lineprinter, and what-have-you for use when the computer is being used at a desk.

An important component of the pocket computer would be the lightpen, the main input device, which would replace the keyboard. It would be attached by a wire, Koil Kord™, or radio link to the computer, and would be similar in operation and construction to present-day lightpens. In primitive versions of the computer, it would be used to "zap" letters displayed on the screen in a pseudo-keyboard; but as pattern recognition techniques get to be more sophisticated, direct handwritten input should become possible (see Figures 1 and 2). Handwritten input would be extremely fast, and very easy to use.

Another input possibility is voice. This is still in the development stage, and is not yet sufficiently sophisticated for our purposes. The essential problem is that the same string of phonemes, or sound units, may mean different things in different contexts. For example, the words "I scream" and "ice cream" are virtually identical in sound, but are easy to tell apart when someone asks you "do you want some ice cream?" or says, "when I hit my finger with a hammer, I scream." This implies that the word-recognition software has to interact with syntactic and semantic parsers, which is rather complicated.

Voice output, on the other hand, though technologically a "solved" problem, is very limited in its application because it requires the user to remember what's been said.

The main output device would, of course, be the screen. Full graphics as well as characters are possible since the hardware would presumably *bitmap* the computer's RAM onto the screen: that is, each bit in the bit-mapped memory would correspond to a dot on the screen; if the bit is "high" the dot lights up; if "low," it is dark. However, the addition of graphics generation to the other input/output chores of the processor would probably slow it down to an unacceptable pace. Therefore, a slave processor could be used to handle all I/O operations, while the main processor did the "heavy thinking." The slave would have full graphics routines and I/O handlers on ROM, with the capability of drawing vectors, arcs, geometrical figures, or whatever.

One problem with this scheme is mass storage. Traditional mass storage is very bulky; floppies are an improvement, but there is no way they are going to be made pocket-sized. I see two possibilities here. The first is to use some type of miniaturized card or tape reader/writer like those on the SR-52 and HP-65. These could be either magnetic, or, possibly, laser-based optical

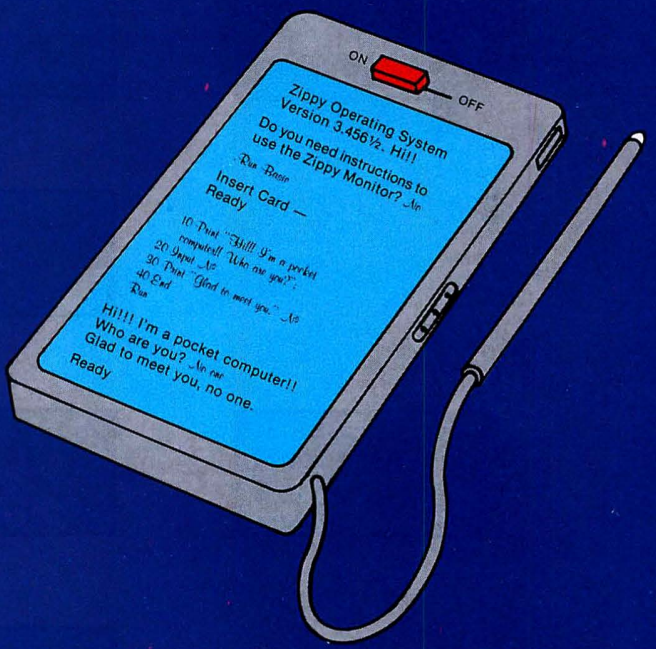

Figure 2. The Pocket Computer; An Advanced Model

devices like video discs. The other possibility is to use magnetic bubble memory, which is limited in the amount of information it can store.

By the early 1980s when this becomes commercially possible, natural language processing may have advanced to the point where computers could be programmed in a subset of English or a synthetic language like Loglan. This may or may not be desirable. Although natural languages are hardly optimal for computer programming, they might allow those who don't want to learn "computerese" to program simple applications for which they can not find a "canned" program.

The pocket computer might be a good machine to implement some of the *far out "reactive grand national* computer network" type of ideas that are in the air, like Xerox PARC's Dynabook, Ted Nelson's Xanadu system, and SRI's NLS. This is simply because the pocket computer is, I believe, the trend for the future.

The technology for all of the hardware ideas I have mentioned is available NOW, but someone (Zilog, Intel, et al., are you listening?) has got to make it affordable. To be practical, the maximum price that would make a pocket system competitive with the micros is about $1000, and a $25.00 model would certainly be much better.

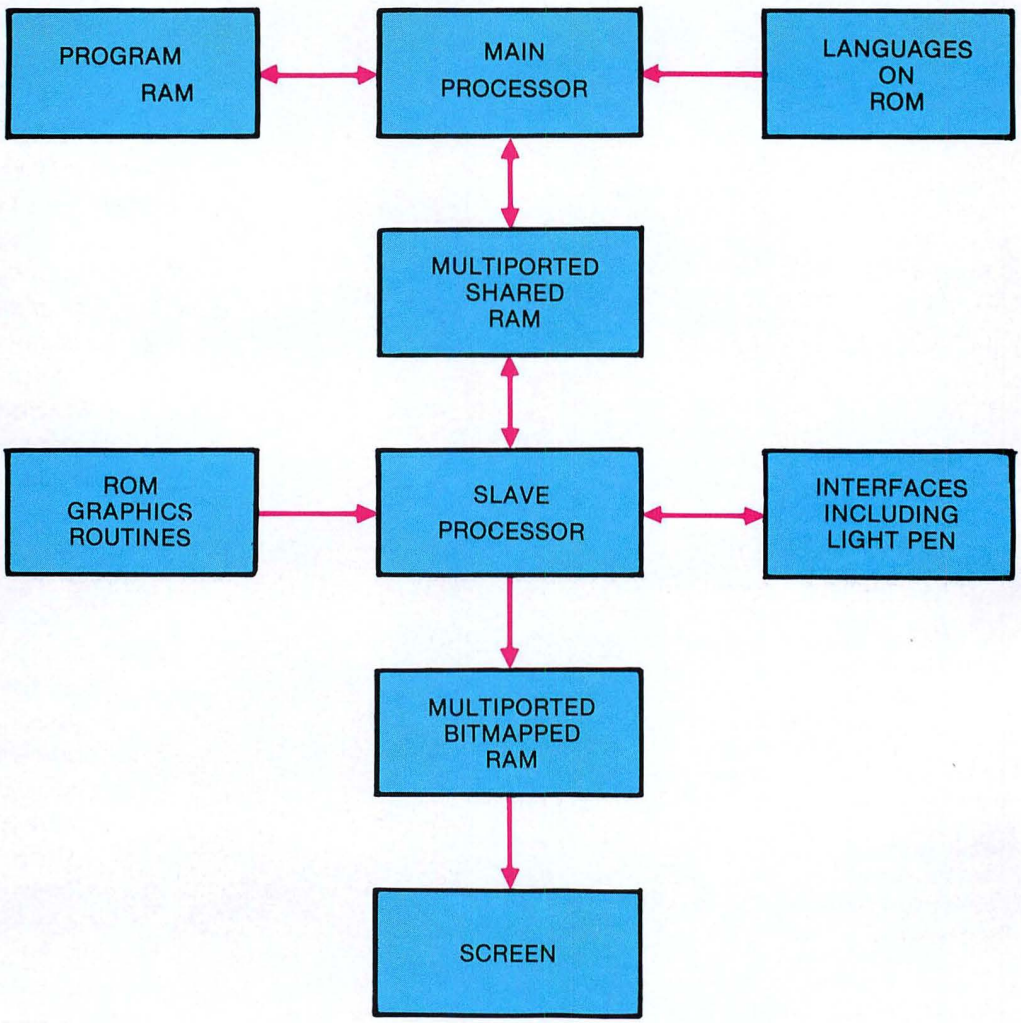

Figure 3. System Diagram

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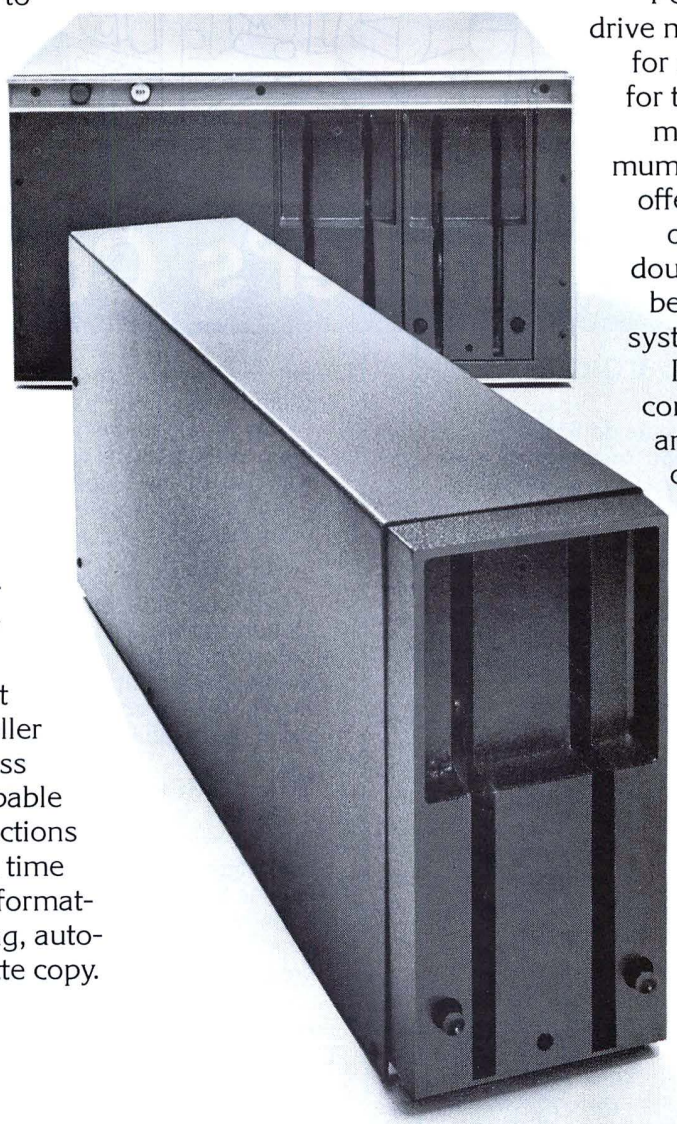

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PERSCI

Peripherals a Generation Ahead.

The Homemaker's Computer

By Lore Harp and Carole Ely*

The cover of this month's issue depicts a product in a situation which two years ago might have been considered a Buck Rogers fantasy — the home, or personal, computer.

Technology has spawned a host of products, readily available, through an entirely new retail outlet structure, and at a price which has made a computer for the homemaker more of a reality than ever. Computer retailers report this as the fastest growing segment of the data processing industry and is just barely getting started. Wait for what will happen in 1978!

Any number of articles in electronics and computer magazines have touched on the many things a computer can do around the home. Most are possible, some are not, others are merely the whim of the writer. What is important is that today it makes sense to own a computer for home use. A growing number of systems assembled or in kit form are sold not just for entertainment of the electronics hobbyist, rather for specific purposes and use by family members.

THE PRESENT INFLUENCES . . .

While the majority of systems sold by computer stores are admittedly sold to small businesses, whose expansion depends on the capabilities of a data processing system, the mere exposure to the computer made possible by low-priced mini and now micro computers on the market has planted the seed. The industry can now supply systems and peripherals to individuals employed in various phases of data processing, who could not afford to own the type of equipment used during the business day, but that equipment challenged them by continual exposure.

Any businessman whose financial problems have been solved in his business by a computer can readily transfer the time-saving aspects of data processing to a home level data-base management system — even without understanding the under-the-hood technology.

The computer exerts an influence even among elementary school children, from its use in the classroom. Children today are becoming quite comfortable addressing a computer and, in the not too distant future, a knowledge of data processing will be a prerequisite for high school or college in much the same way as is basic math or the ability to read.

THE COMPUTER IS NOT A VIDEO GAME

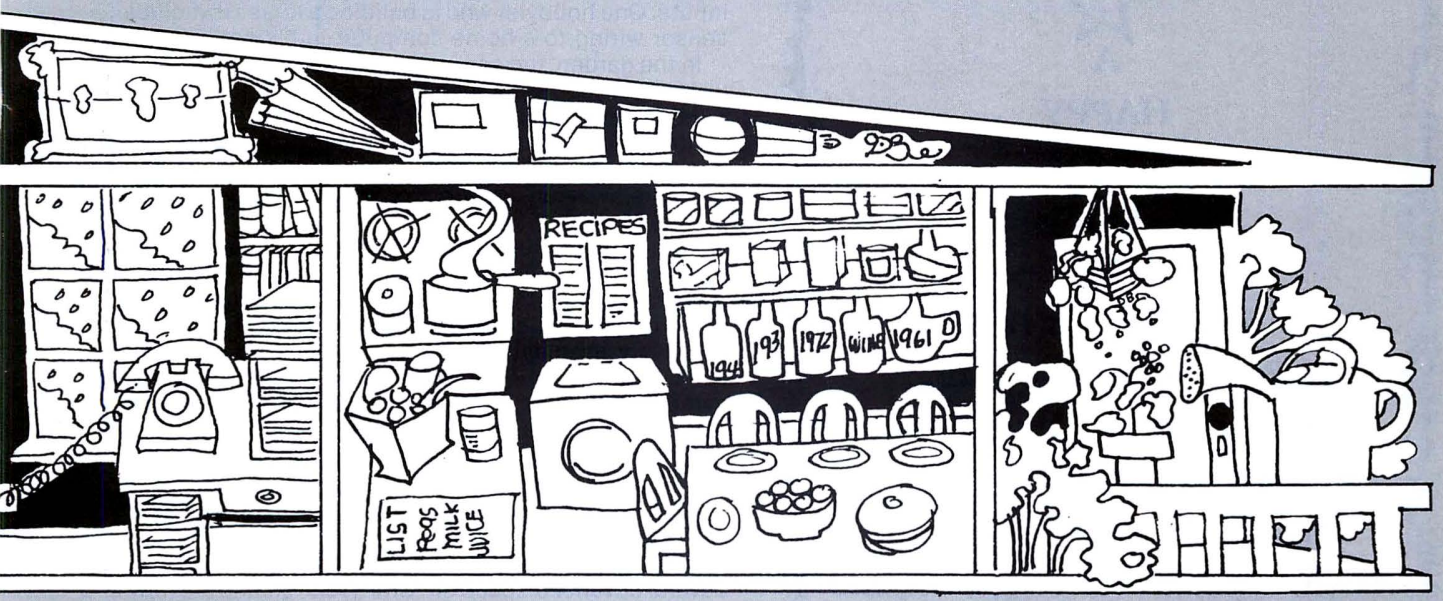
Despite some contrary sentiment, the home computer is not a more expensive version of the under $100 video game attachment for the home television set. Games available in software, or to-be-programmed, are sophisticated and mentally stimulating on a highly professional level. With hobby computing the very act of programming offers a challenge.

THE POSSIBLE

A laundry list of tasks for the home computer is limited only by imagination. An obvious problem is to assign a task to the computer which is far beneath its true capabilities. We talk of appliance monitoring, but having the computer turn on the morning coffee can also be accomplished with a $9 timing device with an AC outlet.

Technology has advanced to the point where solution to an exotic use for the home computer rests in the purchase of the right board, primarily those which extend memory capacity, and existing software, or design of

*Msdsmes. Harp and Ely are proprietors of Vector Graphic, based in Westlake Village, California, one of the pioneer firms offering microcomputers and boards in kit or assembled form.



— Fact, Not Fantasy

original software. The last two items are readily traded through computer clubs, between individuals with a helpful dealer as intermediary, or the subject of a growing number of books and computer magazine articles.

Today the home can be viewed as a small business in itself, hence it is a prime market for the home computer. An initial program would deal with financial planning and family budget control. Tasks such as checkbook balancing, comparisons of expenditure against budget (and comparing these figures to prior periods), determination of loan annuity, interest calculations and analysis, are examples. A daily diary program would alert the family on a day-to-day basis to pending loan or lease payments, as well as family obligations such as birthdays, holiday plans, and other expenditures.

A home financial system software package also simplifies the calculations and organization of items required for filing of state or federal income tax returns or other required filings, such as a record of wages paid a domestic servant.

Real estate investments — including one's own home — can be analyzed with respect to true dollar value against percentage increases in inflation, interest rates or amount remaining on a mortgage. Projections for current and future years can be run for analysis. As new data are acquired, new projections can be run and stored, replacing out-of-date figures.

The computer can also serve as a ready address or telephone file. In a text editing mode, even a bothersome greeting card list could be entered, stored in memory, and recalled for use, change or elimination.

Attached through appropriate interface devices, the computer could monitor phone calls on a time and cost basis. Incoming calls could be monitored, an answer (perhaps one of several) provided the caller, and a response taped for review at a later time.

Without yet leaving the kitchen, several other tasks come to mind. Pantry basics could be programmed as one would handle inventory control. As items are used, quantity is subtracted from memory, and as critical levels are reached, items are then transferred to a shopping list file.

The idea of storing recipes is not new. There are catering programs for big systems. Recipes could be chosen on the basis of calorie count or nutrition value. The interaction of the computer solves the problem of portion control for any size family gathering. A recipe for three can easily be calculated for five or seven.

For a large dinner party, the problem of creating a workable seating plan can be posed to the computer, with each guest programmed as to profession, age, sex, and specific likes and dislikes, hobbies, etc. At the dinner party, telling the guests they were computer-matched certainly would generate some lively conversation!

The home wine buff can program his favorite selections on the basis of inventory control, or in conjunction with menus in memory. Basic data on vineyards, growth years, and type could be programmed for ready reference prior to purchase. As a certain growth reaches maturity, data are accordingly edited.

The home computer can be coupled to TV equipment. An entire week's favorite television programs could be programmed and the computer assigned to do one of several ingenious things: signal an alarm prior to air time, turn on the set, or control a videotape recorder.

The home burglar alarm monitored by computer has been mentioned, but here again simple switches at each means of access to the home hooked directly to the alarm would be just as effective. The computer used as a true monitor, could be attached through a series of sensors, to record not only which door or window might be tampered with by an intruder, but the first wisps of

smoke from a potentially damaging fire, gas fumes, or even water seepage in the basement or a roof leak.

Computer climate control, again with the appropriate installation of sensors, adjusts individual room or zone temperature and humidity, based on total environmental inputs. One hobbyist who is building a house is including sensor wiring to a home computer in his schematics.

In the garden, the computer can provide more efficient watering based on sensing sub-soil moisture content, rather than arbitrary electrical or mechanical systems controlled by time. The computer can be programmed to handle all watering chores for several weeks while the family is away on vacation, or relieve the family of this task for good.

Proper maintenance of the family car can be easily solved by the home computer. Critical inspection periods as a function of elapsed mileage can be entered in the program, then as mileage is fed into the computer weekly, or even daily. Items due are flashed on the CRT as a reminder and assembled in list format for the garage mechanic. The list also can be amended to include programs uncovered during operation, which are fed into the computer as mileage is entered.

A number of microcomputers are being sold to the electronic hobbyist, who finds challenge in building computer and board kits, doing his own programming, and applying the computer to one or more hobbies. Several advanced space or "Star Trek" games are now in use, whose format ranges from a simply equipped starship battling one aggressor to a real time space war involving several ships, exotic weapons choices — even three or more players.

Educational games are not beyond the grasp of even a five-year-old. Children find a certain fascination with the terminal keyboard and CRT screen, and the ability to make things happen on what appears to be the home TV screen.

The computer is one of the best teaching aids yet devised because it can tirelessly repeat a problem until the correct answer is given, all the time holding the child's attention. Reading skills also are enhanced as the child "talks" to the computer through the keyboard and reads the computer's answer to "rewards" such as "you're close, try again" or "nice going, want another question?"

High-schoolers find the text editor and printer a real assist in the preparation of term papers and other writing assignments. The student can work with entire blocks of copy on the CRT screen, make final edits, and turn in a paper prepared by the printer, thus eliminating endless rough drafts and the time required to prepare them.

The photohobbyist, for example, could not only maintain a slide or negative file in the computer's memory, but could use the system to monitor temperature of the various chemicals used in the development of negatives and in making enlargements. In color work, for example, chemistry must be maintained within ± 25°C.

Any number of collections — records, books, stamps, coins, etc. — could be filed in the computer's memory, cross-indexed as many ways as the hobbyist desires. Several new interface boards now on the market permit the computer to be used to devise designs, animation and kinetic art, in black and white as well as color. These same boards can also be used to create new patterns to be used in needlepoint, weaving or knitting.

Model railroad control, home computer robots, even Biorhythm charts for each member of the family also are possible with the home computer.

Important, too, is the positive impact personal involvement with home computers is having on the individual. As the true value of the computer is recognized for the benefits it gives the individual, the fear that we are being manipulated by machines is being lost. In its place is an understanding, respect, excitement and challenge.

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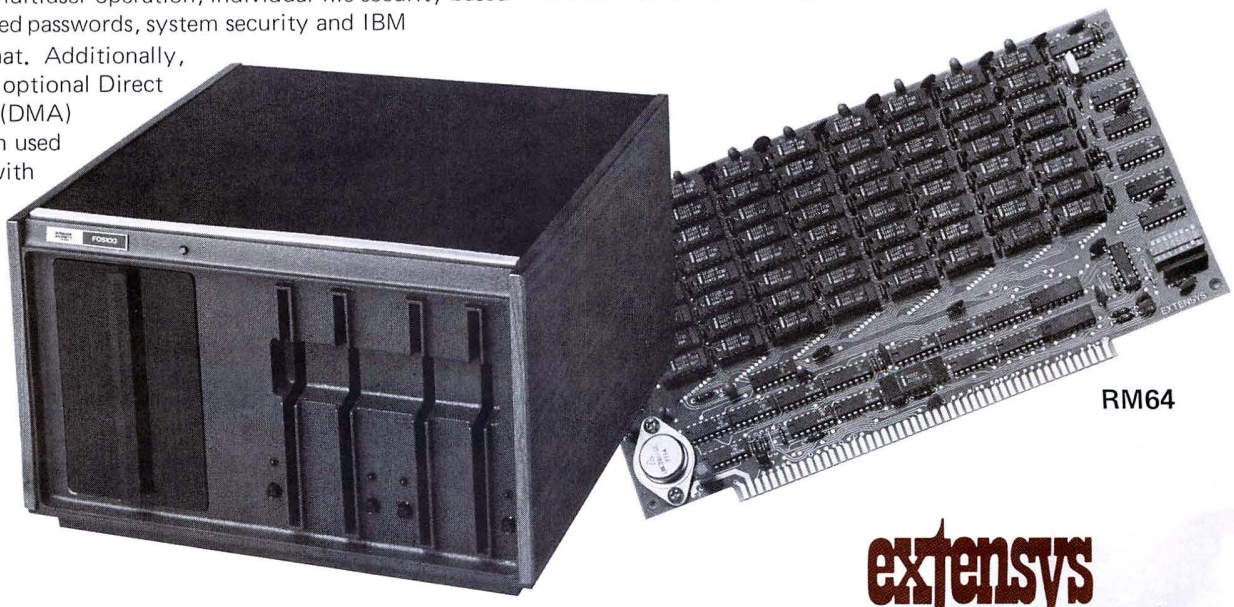

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A FIRMWARE MODEL RAILROAD

INTRODUCTION

One of the most difficult aspects of scale model railroading is that of achieving realistic operation. Model locomotives have a tendency to be jerky, particularly at low speeds. In fact, it is virtually impossible to run most model locomotives at speeds of less than 15 scale miles per hour using conventional controllers.

The problem stems from the heavy frictional losses in the mechanism, particularly in the gear train. Because of these losses, motor current is high at all speeds and varies not so much with speed as with the angular position of the drive wheels. As a result, the locomotive tends to stall or jerk at low speeds with a rheostat or other types of controllers which have high output resistance. Better control can be obtained by using a controller with low output resistance, but speed fluctuations and stalling are still present with most models at low speeds.

A more recent technique[1] is to use full-voltage pulses of controlled width (possibly superimposed on DC) to obtain the desired average output. Because the pulse voltage is high enough to overcome the friction in the mechanism, stalling is no longer a problem. However, the average speed still varies with load, with the result that the locomotive will slow down suddenly when it starts up a grade or enters a sharp curve, unless the pulse width is adjusted to compensate.

Servo techniques can be used to offset both frictional losses and load fluctuations, but a linear servo must be trimmed to compensate for each locomotive's motor resistance. The controller described here uses a combination of pulse and servo techniques to give excellent control for a wide variety of locomotives at speeds ranging down to less than 1 scale mile per hour.

Another objective in controller design is to simulate the enormous inertia of a locomotive. Many controllers do this by charging and discharging a large capacitor to obtain a slowly varying control voltage. In the present design, inertia simulation is done entirely by software, incrementing and decrementing a register to vary the speed slowly.

HARDWARE CONFIGURATION

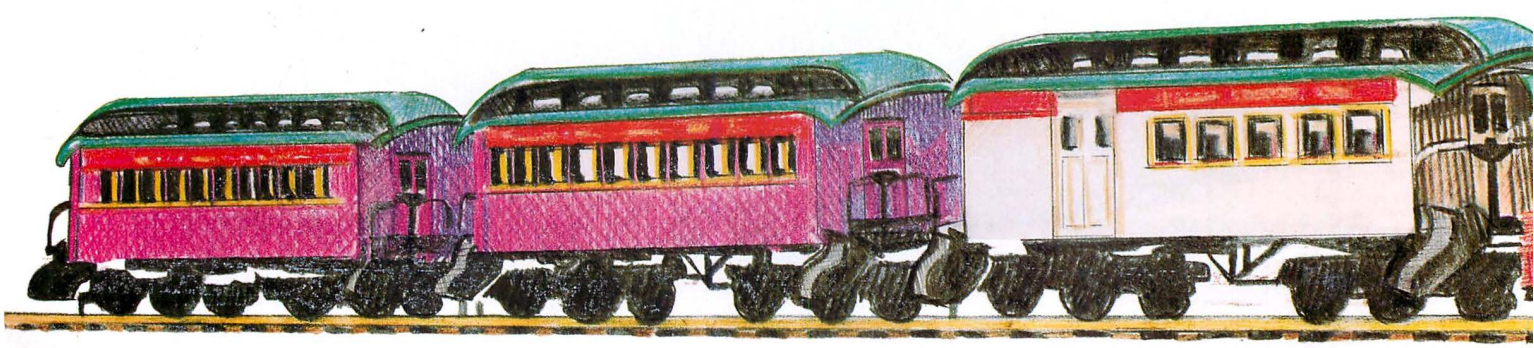
The controller configured here uses an 8080 microprocessor with 512 bytes of ROM, a minimum of RAM (only about 16 bytes are actually used), one input port, and two output ports. The input port and one of the output ports are used in conjunction with a digital-to-analog converter (DAC), a bank of comparators, and a software analog-to-digital conversion routine to implement a cheap form of multi-channel analog input. The other output port is used to pulse the output amplifier.

The output amplifier is bipolar (complementary), allowing direction control to be done in software. As a result, the controller can be programmed so that if the reversing switch is changed while the train is running, instant reversal does not occur; instead the train will gradually slow

[1]Fyffe, David, "Pure-pulse Transistor Throttle," *Model Railroader*, Vol. 32, #1 (January 1965), p. 63.

ACKNOWLEDGMENTS

The author wishes to thank Dr. Damian Gouleff and the Ontario Science Centre for making available the Centre's ELI MMD-1 microcomputer for the development of this controller.



CONTROLLER

By Gifford Toole President, TRACE Toronto Region Association of Computer Enthusiasts

to a stop and then begin accelerating in the opposite direction.

Two of the analog inputs are used to measure the motor voltage, one for each direction, giving 8-bit resolution in either direction. A third analog input is used for the throttle setting, which is a voltage between 0 and 5 volts (derived from a pot). The spare bits of the input port are used for the direction switch and the brake.

Detailed schematics for the bipolar output amplifier, low-pass filter, and analog-to-digital conversion circuits are shown in Figures 2, 3 and 4.

The output is determined by the state of two bits of latched output Port 1. When bit 0 is one and bit 1 zero, transistor Q1 turns on, which in turn switches Q2 and Q3 on, giving full (nearly 12 volts) positive output. When bit 0 is zero and Bit 1 is one, Q1 is reverse-biased but Q4, Q5 and Q6 turn on, giving full negative output. When bits 0 and 1 are equal, all transistors are off and no output current results. Note that under no circumstances can both halves of the output amplifier be biased on simultaneously. Q7 and Q8 provide current limiting, turning on only if the average output current exceeds 1.4 amps or the instantaneous output current exceeds 3 amps. (Stated more exactly, Q7 and Q8 limit the magnitude of the output current I such that .22 I + .5 Iav < Vbe.) The output clamping diodes limit inductive voltage transients from the motor when the transistors switch off.

The low-pass filter is really two simple low-pass filters, one inverting and the other non-inverting. This is done because the DAC produces an output of one polarity (+) only. When the amplifier output is positive, the non-inverting filter output is positive and is converted to an 8-bit (unsigned) number by the ADC routine, while the inverting filter output is negative and converts to zero. This technique avoids the offset errors which would crop up if the DAC output were offset to accommodate bipolar signals, and, at the same time, maintains 8-bit significance in the conversion.

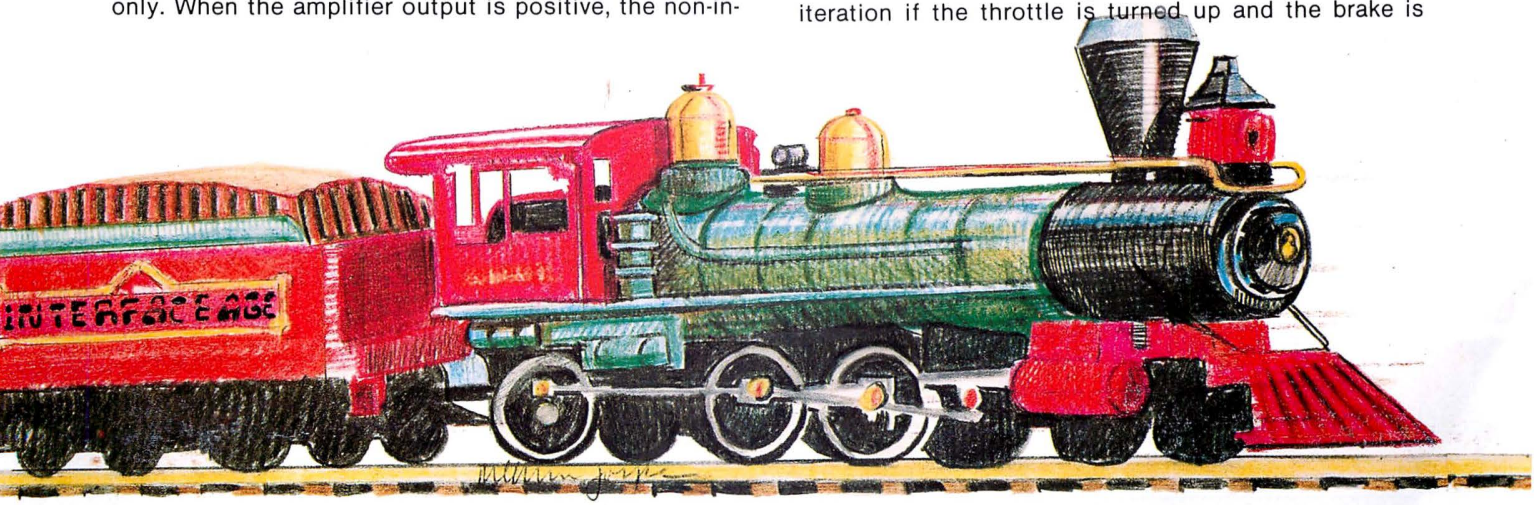
The software is described in Figure 5 as a set of APL functions. The APL notation is used because it affords a more concise, detailed description than is feasible with flowcharts.

SOFTWARE

The main program consists of an infinite loop which samples the motor voltage which, between pulses, is proportional to the speed, compares it to the desired speed, calculates how long the next pulse should be, delivers a pulse, then checks the control settings and adjusts the desired speed accordingly.

Analog-to-digital conversion is done by successive approximation (function ADC). The inputs from all but one of the comparators are ignored during any one conversion; a mask supplied as an argument to the ADC routine determines which bit is used. The next pulse width is calculated by a proportional-plus-integral control algorithm (next pulse).

The current desired speed is a 16-bit number (speed), kept in the HL register pair, of which the high-order eight bits are used in the speed comparison and pulse width calculation. The register is incremented on each iteration if the throttle is turned up and the brake is



released. If the brake is on, the register is decremented. Drag is simulated by applying a small decrement on each iteration. Negative numbers are used when the locomotive is running in reverse.

CONCLUSION

The firmware approach affords considerable flexibility in the design of a controller. Extra features can be added by simply changing the software (e.g., loss of steam pressure, running out of water or fuel, etc.). The unit can also be programmed to control two or more locomotives independently. The only additional hardware required consists of an output amplifier and three analog input channels.

```
     ∇ MAIN
[1]    SPEED← 0
[2]    PULSE← 0
[3]   LOOP:PULSE← PULSE NEXTPULSE SPEED
[4]    DELIVER PULSE
[5]    SPEED← SPEED + (THROT SPEED ⌈ (DRAG SPEED) ⌈ BRAKE SPEED)
       ÷ TIMECONST
[6]   →LOOP
     ∇

     ∇ P← PULSE NEXTPULSE SPEED
[1]    P← (0.5 × PULSE) + 2 × (SPEED - CURRENTSPEED)
     ∇

     ∇C← CURRENTSPEED
[1]    C← (ADC FORWARD) ⌈ ADC REVERSE
     ∇

     ∇ R← ADC MASK;C
[1]    R← 128
[2]    C← 128
[3]   L:R OUTPUT 0
[4]    C← C ÷ 2
[5]    →EXIT IF C < 1
[6]    →LOW IF 0∧.= MASK INPUT 0
[7]    R← R - C
[8]    →L
[9]   LOW:R← R + C
[10]   →L
[11]  EXIT: →RET IF 0∧.= MASK INPUT 0
[12]   R← R ⌈ 1
[13]  RET:
     ∇

     ∇ T← THROT SPEED;D
[1]    D← DIRECTION INPUT 0
[2]    →MAX IF D∧.= 0
[3]    SPEED← ⌈ SPEED
[4]   MAX:T← (ADC THROTTLE) × (MAXSPEED + SPEED)
[5]    →RET IF Dv.≠0
[6]    T← ⌈ T
[7]   RET:
     ∇

     ∇ D← DRAG SPEED
[1]    D← 0
[2]    →RET IF SPEED = 0
[3]    D← DRAGCONST
[4]    →RET IF SPEED > 0
[5]    D← ⌈ DRAGCONST
[6]   RET:
     ∇

     ∇ DELIVER PULSE;D;C
[1]    →NEG IF PULSE < 0
[2]    D←FORWARD
[3]    →SH
[4]   NEG:D← REVERSE
[5]    PULSE← ⌈ PULSE
[6]   SH:PULSE← 2 × PULSE
[7]    C← 0
[8]   L: →OFF IF C = PULSE
[9]    →ON IF C = 0
[10]  L1:C← C + 1
[11]   →L IF C≠256
[12]   →RET
[13]  ON:D OUTPUT 1
[14]   →L1
[15]  OFF:0 OUTPUT 1
[16]   →L1
[17]  RET:
     ∇

     ∇ B← BRAKESPEED
[1]    B← 0
[2]    →RET IF 0∧.= BRAKE INPUT 0
[3]    →RET IF SPEED = 0
[4]    B← BRAKECONST
[5]    →RET IF SPEED > 0
[6]    B← ⌈ BRAKECONST
[7]   RET:
     ∇
```

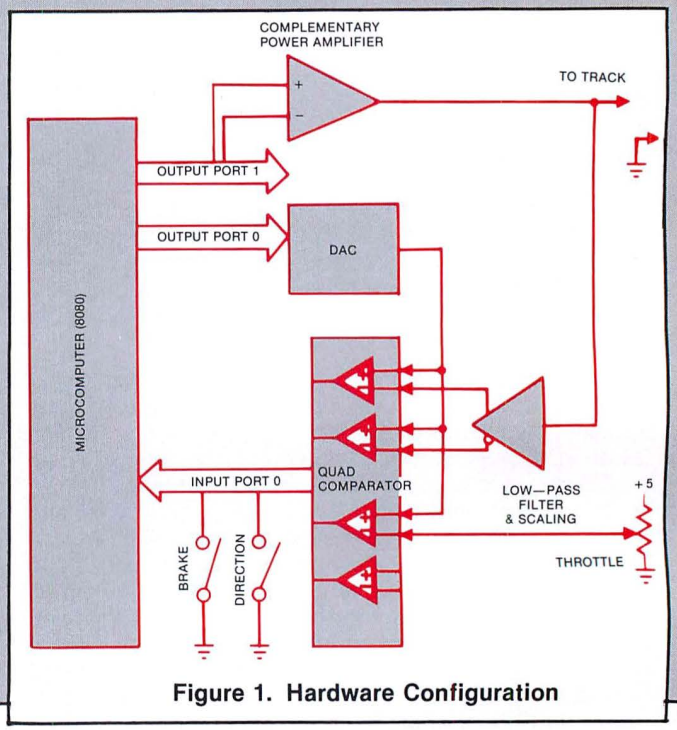


Figure 1. Hardware Configuration

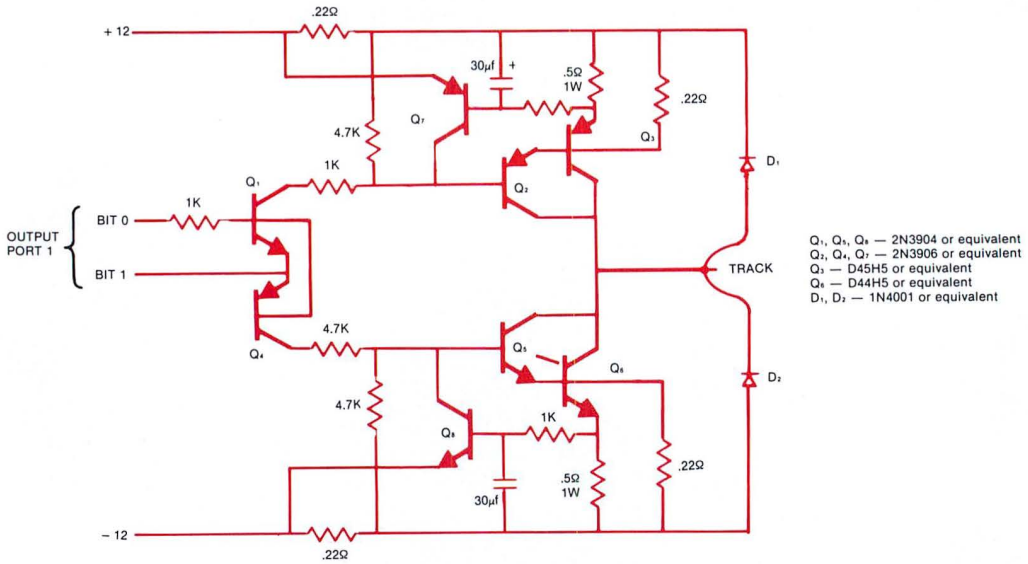


Figure 2. Output Amplifier

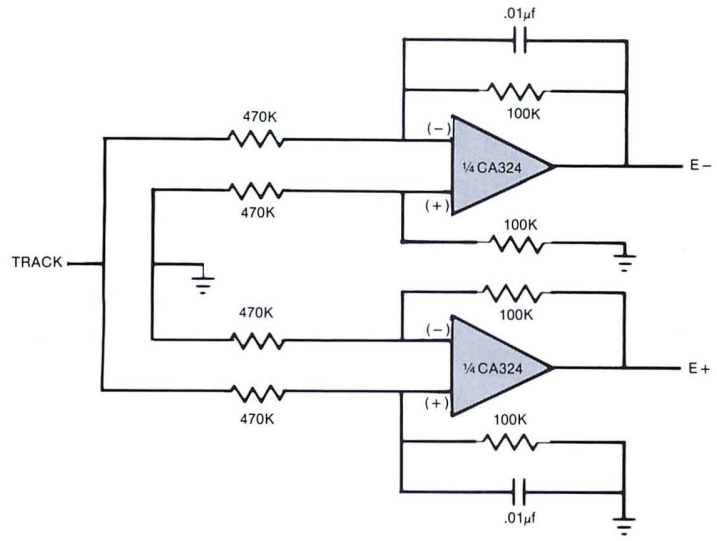


Figure 3. Low-Pass Filter

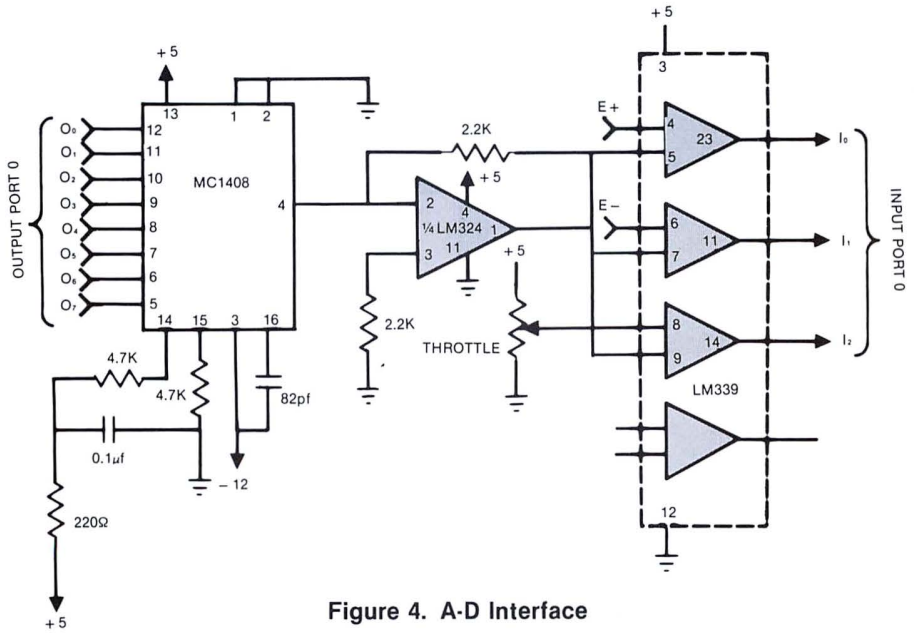


Figure 4. A-D Interface

1. The following constants are used

   TIMECONST — 256
   FORWARD — 0 0 0 0 0 0 0 1
   REVERSE — 0 0 0 0 0 0 1 0
   THROTTLE — 0 0 0 0 0 1 0 0
   DIRECTION — 0 0 0 0 1 0 0 0
   BRAKE — 0 0 0 1 0 0 0 0
   DRAGCONST — 4
   BRAKECONST — 64

2. The Function OUTPUT is assumed to output its left argument to the port whose number is given by the right argument.

3. The Function INPUT is assumed to input a byte from the port whose number is given by the right argument, and "AND" the eight bits with the left argument to produce a result.

Figure 5. Controller Algorithms

Job Cost Estimating By Random Numbers

By William C. Thompson III

The words "random number" usually bring forth images of cards, Las Vegas, illustrations in your Probability and Statistics 101 textbook (I might add — images of the Enterprise and the Klingons are also fair game.) But wait, all of you who are planning a costly project, random numbers will serve you well, too.

For, after all, random numbers are basically a mathematical image or model of the randomness of our real world. Let's examine how a project planner might use random numbers in one aspect of his work. While examining the bids on construction projects which the homeowner made over the past year, he comes to an important conclusion. Each bid made to him, though greatly different as a whole, still consists of variations of the same or similar tasks and materials. Though he can get a good grip on one variable, by the time he takes ten or fifteen more of them at once, the carefully-computed bids aren't much better than the original guesstimates. If there were only some way of restricting the work to each little variable, then cranking it into a machine to figure out how much should be bid.

If the project planner only statistically analyzes all the bids made for all different projects, he will find that the results are almost random.

There is a way to break them all down into the same model. Handle each case as a model; crank out as many trial runs of the model as needed to provide a statistical analysis of each job, or even new jobs! Take one of the bid sheets and instead of each of the guesses, give each item a bit of room to range in. Some of these could use a wider range than others, and a few are fixed. Leave the fixed ones out for now and just add them on at the end.

Now have the computer pick a random value from each range and then use the results as if it actually built it that way. Have the computer "construct" the project as many times as needed and do a statistical analysis of the resulting data.

Now in real life, the values in the center of the range should get picked more often than the outside values, like a normal curve. On the other hand, that may be a bit restrictive — try it both ways: a normal distribution and a random distribution.

Soon the program is up and running with the following results:

Table 1. JOB COST ESTIMATING PROGRAM

```
NUMBER OF TRIALS =?100
RANDOM (1) OR NORMAL(2) DISTRIBUTION?1
```

ITEM NO.	LOWER VALUE	UPPER VALUE	RANGE
1	1200	1300	100
2	200	250	50
3	2300	2345	45
4	2750	3000	250
5	1800	1900	100

```
AVG. PROJECT COST: $ 8519.8
WITH A STANDARD DEVIATION OF:  25.7718
```

ITEM NO.	AVG. COST	STD.DEV.
1	1250.12	9.0167
2	224.934	4.51822
3	2322.42	3.93994
4	2872.38	21.7369
5	1849.94	8.87527

++++ CHANCE OF OVER RUN ++++

TOTAL COST	PROB. OF OVERRUN
$ 8431.4	99.95 %
$ 8453.44	99 %
$ 8469.29	95 %
$ 8493.08	70 %
$ 8519.8	50 %
$ 8546.53	30 %
$ 8570.31	5 %
$ 8586.16	1 %
$ 8608.2	.05 %

Table 2. JOB COST ESTIMATING PROGRAM

```
NUMBER OF TRIALS =?100
RANDOM (1) OR NORMAL(2) DISTRIBUTION?2
```

ITEM NO.	LOWER VALUE	UPPER VALUE	RANGE
1	1200	1300	100
2	200	250	50
3	2300	2345	45
4	2750	3000	250
5	1800	1900	100

```
AVG. PROJECT COST: $ 8522.1
WITH A STANDARD DEVIATION OF:  27.2801
```

ITEM NO.	AVG. COST	STD.DEV.
1	1249.77	9.09024
2	224.987	4.40634
3	2322.35	4.04412
4	2876.27	20.3578
5	1848.71	8.12129

++++ CHANCE OF OVER RUN ++++

TOTAL COST	PROB. OF OVERRUN
$ 8428.53	99.95 %
$ 8451.86	99 %
$ 8468.63	95 %
$ 8493.81	70 %
$ 8522.1	50 %
$ 8550.39	30 %
$ 8575.57	5 %
$ 8592.35	1 %
$ 8615.67	.05 %

Table 3.

```
                JOB COST ESTIMATING PROGRAM

 NUMBER OF TRIALS =?1000
 RANDOM (1) OR NORMAL(2) DISTRIBUTION?1

ITEM     LOWER          UPPER          RANGE
 NO.     VALUE          VALUE
 1        1200           1300           100
 2        200            250            50
 3        2300           2345           45
 4        2750           3000           250
 5        1800           1900           100


AVG. PROJECT COST: $ 8523.61
WITH A STANDARD DEVIATION OF:  24.7341


ITEM NO.      AVG. COST      STD.DEV.
 1          1250.19        8.43583
 2          224.986        4.19953
 3          2322.39        3.75468
 4          2875.91        21.426
 5          1850.13        8.41467


        ++++ CHANCE OF OVER RUN ++++

TOTAL COST              PROB. OF OVERRUN
$ 8438.77                99.95 %
$ 8459.92                99 %
$ 8475.13                95 %
$ 8497.96                70 %
$ 8523.61                50 %
$ 8549.26                30 %
$ 8572.09                5 %
$ 8587.3                 1 %
$ 8608.45                .05 %
```

Table 4.

```
                JOB COST ESTIMATING PROGRAM

 NUMBER OF TRIALS =?1000
 RANDOM (1) OR NORMAL(2) DISTRIBUTION?2

ITEM     LOWER          UPPER          RANGE
 NO.     VALUE          VALUE
 1        1200           1300           100
 2        200            250            50
 3        2300           2345           45
 4        2750           3000           250
 5        1800           1900           100


AVG. PROJECT COST: $ 8522.61
WITH A STANDARD DEVIATION OF:  24.4423

ITEM NO.      AVG. COST      STD.DEV.
 1          1250.28        8.36202
 2          225.028        4.30405
 3          2322.29        3.82765
 4          2874.41        20.6594
 5          1850.59        8.24031


        ++++ CHANCE OF OVER RUN ++++

TOTAL COST              PROB. OF OVERRUN
$ 8438.77                99.95 %
$ 8459.67                99 %
$ 8474.7                 95 %
$ 8497.26                70 %
$ 8522.61                50 %
$ 8547.95                30 %
$ 8570.51                5 %
$ 8585.55                1 %
$ 8606.44                .05 %
```

Table 5.

```
                    ESTIMATING PROGRAM

 NUMBER OF TRIALS =?10000
 RANDOM (1) OR NORMAL(2) DISTRIBUTION?2

ITEM      LOWER              UPPER              RANGE
 NO.      VALUE              VALUE
  1        1200               1300               100
  2         200                250                50
  3        2300               2345                45
  4        2750               3000               250
  5        1800               1900               100


AVG. PROJECT COST:- $ 8522.5
WITH A STANDARD DEVIATION OF:   24.3572


ITEM NO.       AVG. COST       STD.DEV.
  1          1250.01          8.37312
  2           225.01          4.1619
  3          2322.49          3.78222
  4          2875.01          20.8411
  5          1849.98          8.36827


        ++++ CHANCE OF OVER RUN ++++

TOTAL COST                  PROB. OF OVERRUN
$ 8438.96                    99.95 %
$ 8459.78                    99 %
$ 8474.76                    95 %
$ 8497.24                    70 %
$ 8522.5                     50 %
$ 8547.76                    30 %
$ 8570.24                    5 %
$ 8585.22                    1 %
$ 8606.05                    .05 %
```

REVIEWING THE PROGRAM

Input data are a series of ranges for costs of individual items in a proposed estimate. The microcomputer then simulates construction of the project by selecting a random cost within each range. This is done repeatedly, accumulating a statistical profile of the job. When sufficient iterations have been completed the analysis of the results is finished and results printed out.

This program serves primarily as an example, though quite useful. The techniques illustrated are even more useful. The practice of modeling, simulation and analysis can produce solutions to very complex, otherwise unassailable problems. Over a period of years as various home installation and remodeling projects are put into effect, job cost estimating by microcomputer can result in a saving of project dollars as well as a valuable record upon which to estimate the true value of your property improvements.

PROGRAM LISTING

```
00100 DIM A(100,3),B(100),C00100 DIM A(100,3),B(100),C(100),S(100),D(10,2)
00110 GOSUB 00920
00120 GOSUB 01030
00130 GOSUB 01190
00140 GOSUB 00240
00150 GOSUB 00390
00160 GOSUB 00840
00170 GOSUB 00550
00180 GOSUB 00710
00190 PAGE
00200 STOP
00210 REM ************************************************************
00220 REM    INPUT DATA SUBROUTINE
00230 REM ------------------------------------------------------------
00240 REM  NUMBER OF RANGES
00250 READ N
00260 PRINT TAB(8);"ITEM","LOWER","UPPER","RANGE"
00270 PRINT TAB(8);" NO. ","VALUE","VALUE"
00280 FOR I=1 TO N
00290 REM    LOWER, UPPER VALUE
00300 READ A(I,1),A(I,2)
00310 A(I,3)=A(I,2)-A(I,1)
00320 PRINT TAB(8);I,A(I,1),A(I,2),A(I,3)
00330 NEXT I
00340 PRINT
00350 RETURN
00360 REM ************************************************************
00370 REM    TRIAL RUNS OF PROJECT SUBROUTINE
00380 REM ------------------------------------------------------------
00390 FOR J=1 TO M
00400 B3=B2=0
00410 FOR I=1 TO N
00420 GOSUB 01280
00430 B1=A(I,1)+Z9*A(I,3)
00440 B(I)=B1+B(I)
00450 C(I)=C(I)+B1*B1
00460 B2=B2+B1
00470 B3=B3+B1*B1
00480 NEXT I
00490 B4=B4+B2
00500 B5=B5+B2*B2
00510 NEXT J
00520 RETURN
00530 REM ************************************************************
00540 REM    PRINT SUMMARY STATISTICS OF TRIALS SUBROUTINE
00550 REM ------------------------------------------------------------
00560 V=B4/M
00570 PRINT
00580 PRINT
00590 PRINT TAB(8);"AVG. PROJECT COST: $";V
00600 PRINT TAB(8);"WITH A STANDARD DEVIATION OF: ";S
00610 PRINT
00620 PRINT
00630 PRINT TAB(8);"ITEM NO.     AVG. COST     STD.DEV."
00640 FOR I=1 TO N
00650 PRINT TAB(8);I,B(I)/M,S(I)
00660 NEXT I
00670 RETURN
00680 REM ************************************************************
00690 REM    PRINT PROBABILITIES OF OVERRUN SUBROUTINE
00700 REM ------------------------------------------------------------
00710 PRINT
00720 PRINT
00730 PRINT
00740 PRINT TAB(15);"++++ CHANCE OF OVER RUN ++++"
00750 PRINT
00760 PRINT TAB(8);"TOTAL COST","PROB. OF OVERRUN"
00770 FOR I=1 TO 9
00780 PRINT TAB(8);"$";V+S*D(I,2),D(I,1);"%"
00790 NEXT I
00800 RETURN
00810 REM ************************************************************
00820 REM    CALCULATE STANDARD DEVIATIONS SUBROUTINE
00830 REM ------------------------------------------------------------
00840 FOR I=1 TO N
00850 S(I)=SQR(ABS((C(I)-((B(I)*B(I))/M))/(M-1)))
00860 NEXT I
00870 S=SQR(ABS((B5-((B4*B4)/M))/(M-1)))
00880 RETURN
00890 REM ************************************************************
00900 REM    PRINT HEADING SUBROUTINE
00910 REM ------------------------------------------------------------
00920 PAGE
00930 PRINT
00940 PRINT
00950 PRINT
00960 PRINT TAB(20);"JOB COST ESTIMATING PROGRAM"
00970 PRINT
00980 PRINT
00990 RETURN
01000 REM ************************************************************
01010 REM    INITIALIZE VARIABLES SUBROUTINE
01020 REM ------------------------------------------------------------
01030 FOR I=1 TO 100
01040 B(I)=C(I)=S(I)=A(I,1)=A(I,2)=A(I,3)=0
01050 NEXT I
01060 B1=B2=B3=B4=B5=X8=0
01070 X9=-1
01080 FOR I=1 TO 9
01090 FOR J=1 TO 2
01100 READ D(I,J)
01110 NEXT J
01120 NEXT I
01130 RETURN
01140 DATA 99.95,-3.43,99,-2.575,95,-1.96,70,-1.037,50,0.30,1.037,5,1.96,1.2.575
01150 DATA 0.05,3.43
01160 REM ************************************************************
01170 REM    INPUT PROGRAM PARAMETERS SUBROUTINE
01180 REM ------------------------------------------------------------
01190 PRINT "        NUMBER OF TRIALS =";
01200 INPUT M
01210 PRINT "        RANDOM (1) OR NORMAL(2) DISTRIBUTION";
01220 INPUT NO
01230 PRINT
01240 RETURN
01250 REM ************************************************************
01260 REM    GENERATE NORMALLY DIST. OR RANDOM # 0<=Z9<=1
01270 REM ------------------------------------------------------------
01280 IF NO<>1 THEN 01300
01290 Z9=RND(0)
01300 X=-6
01310 FOR KO=1 TO 12
01320 X=X+RND(0)
01330 NEXT KO
01340 Z9=X/12+.5
01350 RETURN
01360 ************************************************************
01370 REM    PROGRAM HISTORY
01380 REM ------------------------------------------------------------
01390 REM DESIGNED AND WRITTEN BY WM. C. THOMPSON III
01400 REM   APRIL, 1977
01410 REM------------------------------------------------------------
01420 REM    END OF PROGRAM
01430 REM ##########################################################
01440 REM  THE FOLLOWING IS SAMPLE DATA-INSERT YOUR DATA HERE
01450 DATA 5,1200,1300,200,250,2300,2345,2750,3000,1800,1900
```

Card of the Month

10-5-9 Quad Chromatic Pitch Generator

By Roger H. Edelson, Hardware Editor

This month I've chosen an out-of-the-ordinary card on which to report — the ALF Products Quad Chromatic Pitch Generator. This card is the basic building block necessary to form a computer-controlled music system. My basic problem is that I am no musician — my last experience with a musical instrument was one semester of intanglement with a French horn in junior high instrument class which I took to escape an art appreciation course. However, one of my children does play the trumpet so I thought with his help something musical might result.

Let's take a look at the description of the 10-5-9 Quad Chromatic Pitch Generator. The first thing you will discover is that the numbers 10-5-9 have no real meaning in relation to the board; they are just ALF code numbers. Don't snicker; it took me 15 minutes of frantic reading of the manual to determine this fact. I caught on when I discovered there is a board 10-5-10 (the parallel output compatible version) and a board 10-5-11 — apparently a timing control board.

After finding out about the other boards I have a feeling this computer-controlled music could be a little like eating potato chips — it may be hard to stop after just one. In order to really do the job right you are going to need more boards — a timing board, a gain control board, probably a means for shaping the envelope of the output waveform (to achieve different instrument sounds), and maybe one or two more pitch generators in order to produce more than four different notes at the same time. Oh well, it's only money, and by the time you get through it will be much more interesting than playing Lunar Lander over and over again.

Back to the Quad Chromatic Pitch Generator — this is a single board which is intended for musical applications as an audio pitch generator. The kit I received was the full quad version which will produce four simultaneous different notes. Options are provided to allow an onboard crystal timing oscillator for producing more correct tones than available through the use of the approximately 2 MHz computer clock which is used in the zero option version. As mentioned previously, an external timing board can also be used. The board is S-100 bus compatible and will plug directly into an S-100 computer and an audio amplifier. One of the very nice features of the manual is that complete details of the S-100 signal loading and timing requirements are provided. I wish more manufacturers would include this type of information.

The board consists of two major portions — a control section and the pitch channel sections. As mentioned, the board may be purchased with from one to four of the pitch channel sections populated. The pitch channels are all independent of each other, but are identical in operation. Each channel may be programmed to produce a pitch corresponding to one of 96 possible tones: from an A natural to a G sharp. This range extends from the lowest note on the piano to one octave above the piano's range.

The control channel contains the board address selection circuitry and the top octave frequency synthesizer. The top octave synthesizer requires an approximately 2.00024 MHz frequency input. Using the S-100 bus clock still results in pitches which are within 0.1% of the A (440 Hz) frequency standard.

The address of the pitch generator may be set up using a DIP switch provided on the board. The switch is used to set the six most significant bits of the board address. Each pitch channel is individually selected by the value of the two least significant bits. 00 selects the first channel, 01 - the second channel, 10 - the third channel, and 11 the fourth channel.

Tone selection is also quite easy; the most significant bit of the outputted byte defines whether the generator is on or off. A 1 in this position produces a tone while a 0 is used for a rest. The next three bits (bits 6 through 4) define the octave to be played. 000 produces the lowest possible octave, while 111 produces the highest octave. The pitch generator thus can be seen to have an eight octave range. Finally, the four least significant bits define the note within the selected octave. A is produced by 0000, and 1011 is G sharp; 1100 and higher are not used. This provides A, B, C, D, E, F and G with the addition of A, C, D, F, and G sharp. One of the advantages of this system is that the output byte is related to the musical note rather than its frequency; therefore no lookup tables are required to find the note corresponding to the selected frequency. This feature greatly simplifies the programming of the pitch generator.

Before going into the operation of the board let's take a look at the kit and the physical aspects of the board. Starting with the manual we find it is well laid out and easy to use. Sections are provided for assembly, performance tests, operating instructions, bus requirements (very nice to have), schematic and layout diagrams, and a section dealing with the reading of sheet music.

Before you start assembly of the kit the manual directs you to check to see if all the components are present. Finally, just before your soldering iron is lifted in anger the manual points out that it is not too late — as you have not yet used any component — you can still return the kit to the suppliers and buy the assembled and tested version! Throwing *caveats* to the wind, however, I plunged head on into board assembly. An almost trivial task, it took no more than 45 minutes.

The board is fully socketed, and the installation of the sockets is the most time-consuming portion of the board assembly. About 60 other components must be assembled — about 25 capacitors, 30 resistors, one transistor and one voltage regulator. Concerning the integrated circuit voltage regulator (LM340T), no provision is made for providing even the most rudimentary heat sink for the device. While there is a large board pad at the heat sink portion of the regulator, no provision has been made to connect the IC tab to the board. A simple screw hole and 6-32 screw and nut would have been nice. I plan to modify my board by drilling this hole and adding a small "finger" style heat sink.

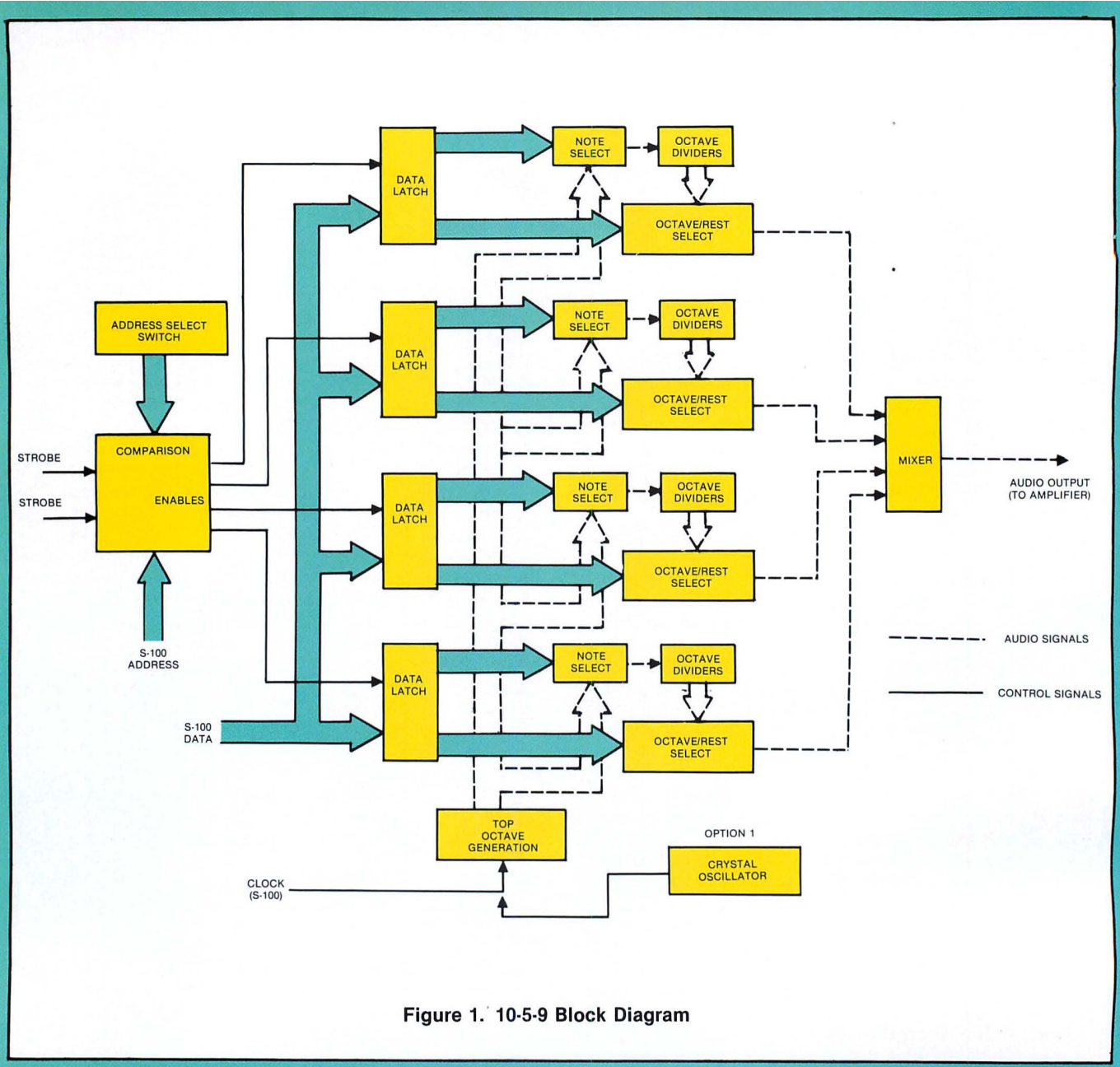


Figure 1. 10-5-9 Block Diagram

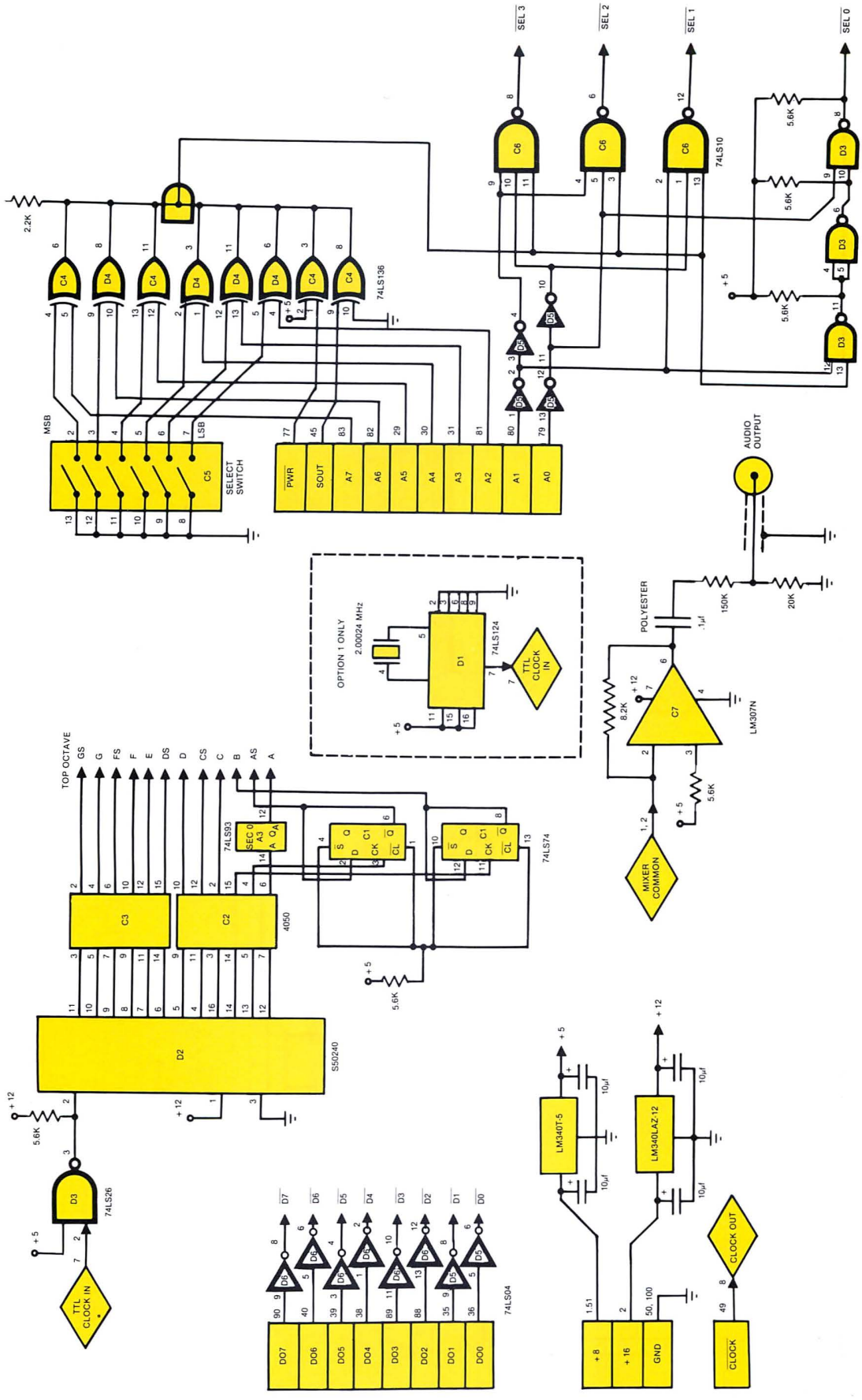


Figure 2. 10-5-9 Control Section

The component identification on the board is well marked and the kit is easy to assemble. The edge board connectors are gold-plated for reliability; the printed circuit traces are tinned for easier soldering. No solder masking is provided and its presence is missed. Soldering would have been a little easier if a solder mask had been provided. The use of very thin traces for most of the signal leads minimizes the problem of solder bridges by providing a substantial pad to trace clearance.

Power routing is done with a substantial trace width, and adequate filtering is provided. As mentioned, a DIP switch is provided to setup the board address. It is a little low on the board to allow for a change of address while operating the system, but this is no particular problem. A DIP socket and header are provided to setup some of the allowable options. The manual directs you to install the ICs prior to board cleaning and inspection of the board for solder bridges, etc. I prefer to do these chores prior to the insertion of the ICs (at least when you have a socketed board). I would certainly follow my sequence with this board because of the sensitivity of ICs C2, C3 and D2 to destruction by voltage transients. The manual is very careful to caution the assembler to take the correct anti-static precautions when inserting these devices.

Having completed assembly of the board, let's proceed on to its operation. Figure 1 shows a block diagram of the 10-5-9 board, and Figures 2 and 3 are schematic diagrams of the control section and channel section respectively.

ICs C4 and D4 form a comparator finding equality between A2 through A7 of the S-100 bus Address and the 6 switches of the DIP address selection switch (C5). Additionally, two of the gates are used to AND PWR and SOUT as a strobe. The outputs (of C4 and D4) are wire-ANDed to form the enable of a 2 line to 4 line decoder network formed by ICs C6, D3 (Gates 6, 8, and 11), and

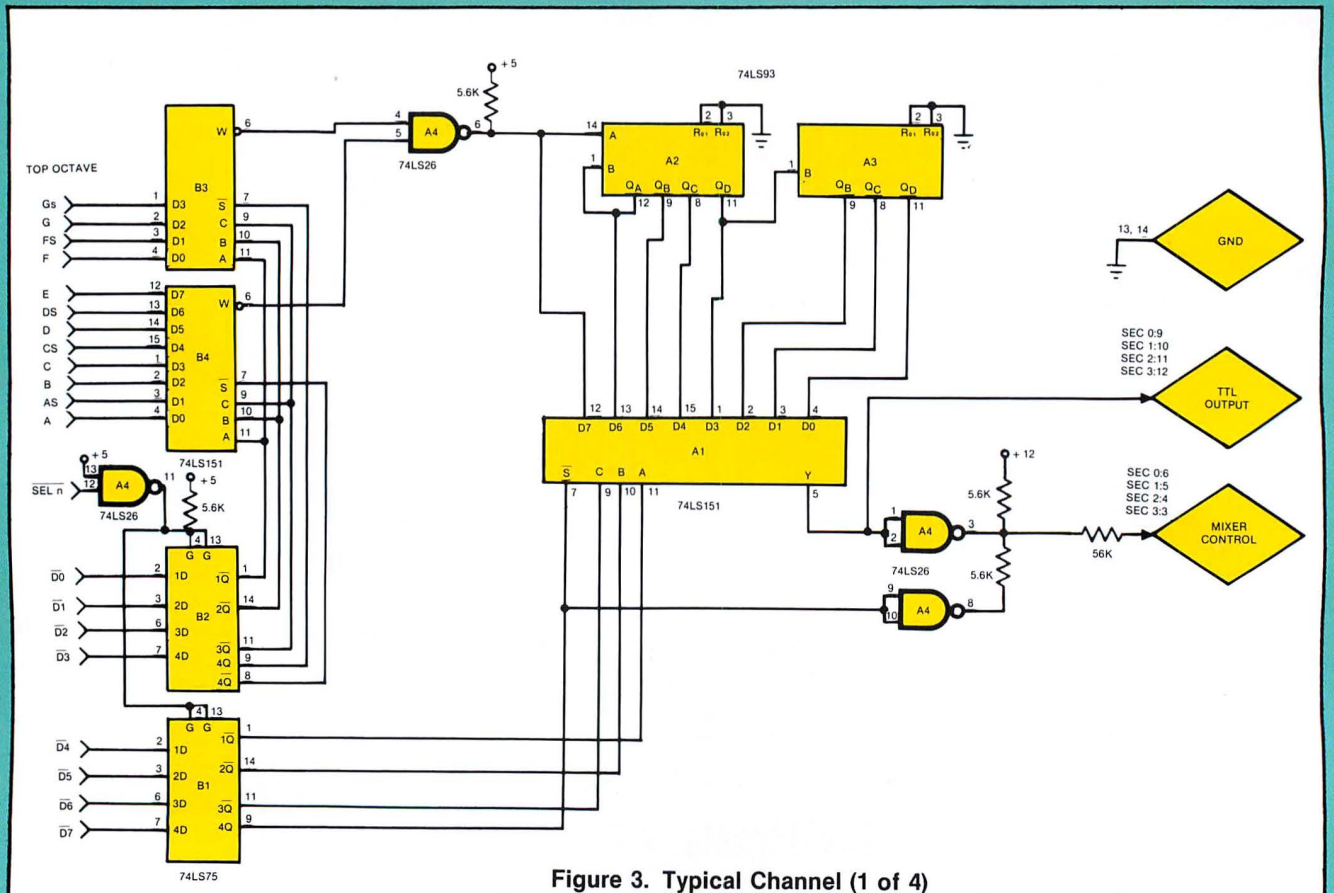


Figure 3. Typical Channel (1 of 4)

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D5 (Gates 2, 4, 10, and 12). The four outputs of the decoder form the channel selection strobes which activate the latches in each section.

The reference frequency is buffered by D3 (Gate 3), level shifted, and fed into the frequency reference of D2, a top octave frequency synthesizer. The 12 outputs of D2 are buffered by C2 and C3 which also provide level conversion (to TTL levels). The three highest frequency outputs are shifted down one octave (divided by 2) by C1 and part of A3 (from Section 0). This forms a contiguous scale which starts at A natural.

ICs D6 and D5 (Gates 6 and 8) serve to buffer and invert the S-100 data lines.

Op amp C7 is used as a four input mixer. It also provides level conversion to level requirements for audio amplifiers.

With option 1, IC D1 forms a 2.00024 MHz oscillator using a crystal as a frequency reference. The output is fed directly into pin 2 of D3 which is also connected to pin 7 of the option header. This converts pin 7 from an external clock in signal to a clock out signal. Option 1 is used when CLOCK is not 2 MHz, or when a more accurate clock is desired.

ICs B1 and B2 latch the note select data from the S-100 bus. The outputs of the latches are used to select one of the 12 top octave frequencies (ICs B3 and B4). IC A4 OR's the outputs of B3 and B4 to complete the top octave frequency selection. The output of A4 (pin 6) is divided by ICs A2 and A3 to form 8 octaves of the selected note. One of the eight signals is selected by IC A1 using select information from latch B1. Note that the S input (pin 7 of A1) is used to select a "rest" (no output) by deselecting A1. The final selected note in the proper octave is available at the Y output (pin 5) of A1 in TTL levels. Gate 3 of A4 converts this signal to proper level for the op amp mixer in the control section (see above). Gate 8 of A4 pulls the mixer input to a null point during a "rest."

One of the nice features provided by the use of the data latches is that once a channel has been directed to output a tone it will continue to produce the tone until turned off. This certainly simplifies the programming for producing notes. Also, the pitch generator is inactive when an input command is issued. This means that it may be assigned the same address as a teletype (or another device) and the board would play the output to the teletype. The parity bit would somehow have to be set to a one for all characters to avoid rests.

Once you have your board built all that needs to be done is to connect it to a suitable amplifier system. However, please be careful to follow the instructions on the grounding of the two systems. At this point the manual instructs you to follow the performance tests in the exact order given to avoid possible damage to the board. A quick run through the performance tests will demonstrate if the board is functioning correctly. Luckily mine did, because no troubleshooting information is provided. The board is not so difficult in conception that it should be a problem to fix. As in all cases first check for solder bridges and incorrect part placement. As I said earlier, the kit is easy to build so you should have no difficulty.

For those of us who managed to flunk instrument class ALF Products has included a six-page section on reading sheet music. While this section is not entirely comprehensive, nor could it be in just six pages, it is more than sufficient to lead the novice to a point where he could translate sheet music into a computer program for the pitch generator.

I now have a device which can play four separate notes simultaneously with or without a manual gain control. I am looking forward to other offerings by ALF with respect to music generation so that I can augment this device and increase its musical ability. Good harmonies to all of you.

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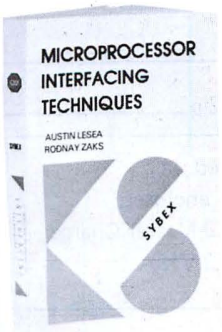

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THE BYTE SPY

by Paul M. Jessop
West Midlands, England

Because of their dynamic characteristics and for other reasons, many microprocessors are difficult to single-step. If the speed penalty is no problem, then self-emulation can be used to debug programs, but where the debugging must be done in real time, problems can develop. The device proposed here should help to ease these difficulties.

The basic idea is that a "map" of the memory is presented to the user and when any 256-byte page is being accessed by the microprocessor, an LED beneath that part of the map is lit. Since there are 65536 bytes accessible to the processor, there are 256 pages of 256 bytes each. Each of these pages requires one LED and thus 256 LEDs are called for. At 10¢ per LED, this puts the cost in LEDs alone at over $25; this seems a good deal but the utility provided by the device outweighs this cost. However, an economy version is also presented but this lacks some of the ease of use of the full version.

Reference to Figure 1 will reveal the block diagram of the full device. This is almost self-explanatory but a few words are in order. The two high nybbles of the address bus are buffered and fed to 4-bit to one of 16 decoders. These feed LED drivers which drive the rows and columns of a 16 x 16 array of LEDs. This behaves rather like a multiplexed 7-segment display. Only one of the

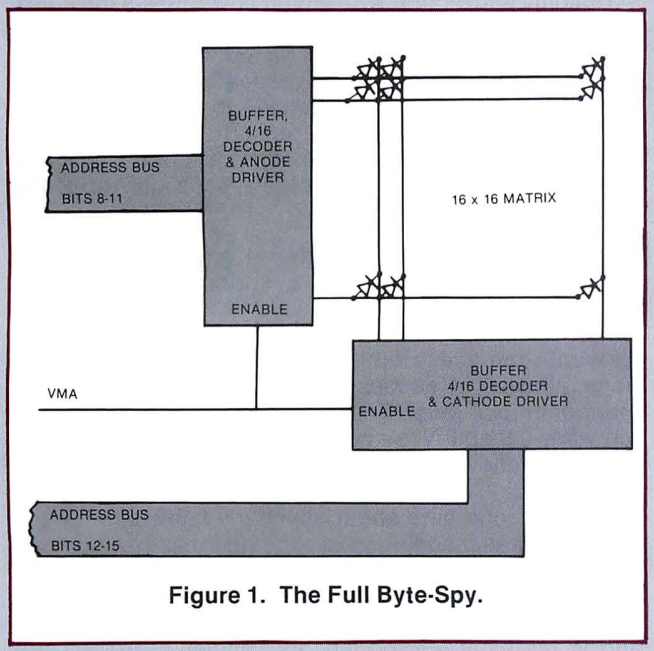


Figure 1. The Full Byte-Spy.

devices is on at any time but because they are accessed so rapidly, any which are briefly on appear to be on continuously. In a 6800 system, VMA being high indicates that there is a valid address on the bus. In systems using other microprocessors, the signal with the same function should be selected or constructed.

Figure 2 shows the economy version. The principle is the same but the number of LEDs is reduced from 256 to 32 by having only one in each row and column. This version is useful if the micro is locked up in an endless loop in a single page but if the number of LEDs lit on either side of the matrix exceeds one, the display becomes ambiguous but can still provide useful information.

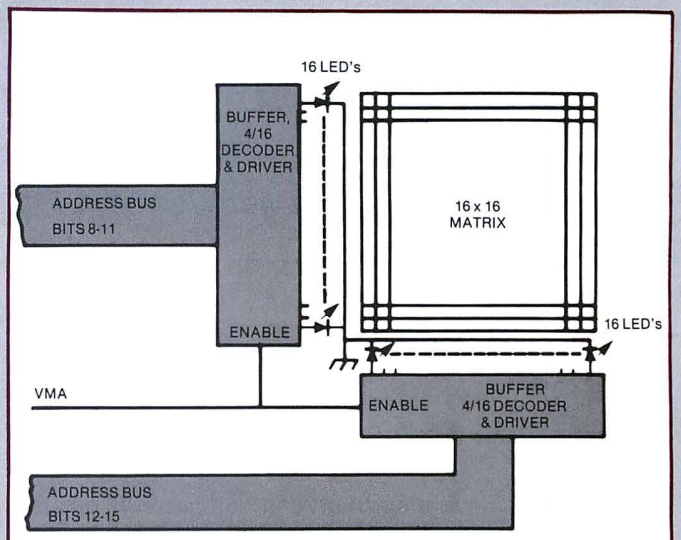


Figure 2. The Economy Byte-Spy.

If more detailed information is needed, the inputs can be switched, using data selectors (74157), between the two higher and the two lower nybbles of the address. Under any circumstances, the LEDs can be placed under a plexiglass panel and the areas of available memory allocated to various functions marked on it as in Figure 3.

In summary, users of the 6502 (etc.) could "AND" the VMA signal with SYNC to enable the drivers to display only where OP-CODES are fetched from, not data etc. If included, the feature should be switchable to give the facility of either mode.

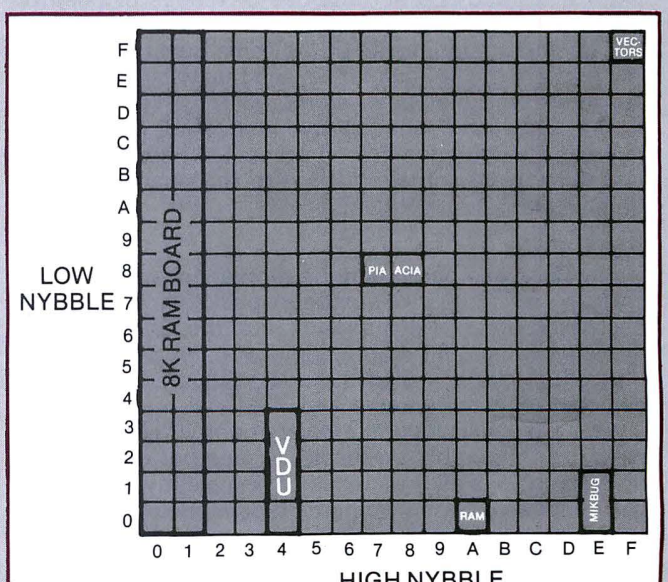
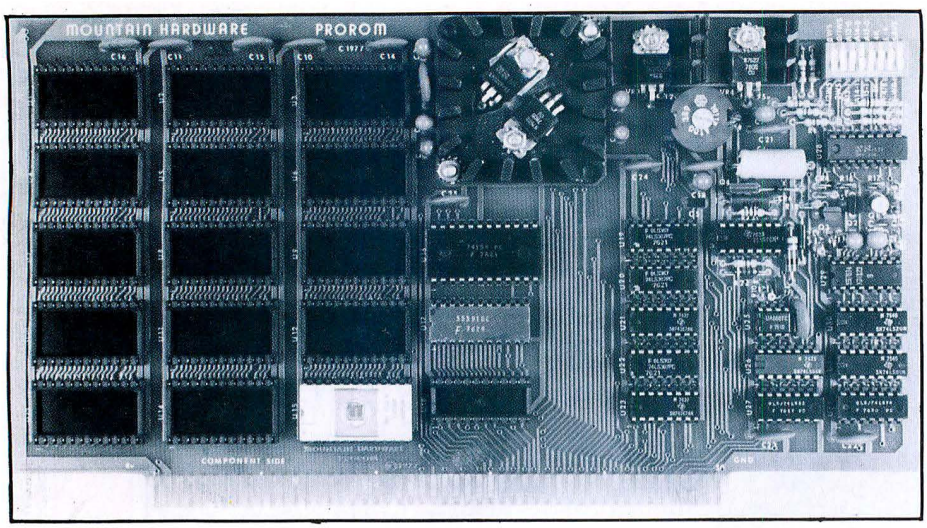


Figure 3. A typical memory map for use with the Byte-Spy. Note that the sides are in accordance with the conventino used with Cartesian co-ordinates, i.e. first (high) figure on the bottom.



I found this kit to have an excellent board, everything else first quality and good documentation written in clear and direct English.

Review of PROROM Board

By Chris Terry

The PROROM is a kit that I can unreservedly recommend. Much forethought and good engineering has gone into its design and production; good documentation is supplied with it, and both Mountain Hardware and Charlie Pack, who wrote the monitor, are courteous and very helpful if a telephone call is necessary. The monitor has one outstanding feature that deserves special notice.

MATERIALS

The PC board is of excellent quality. The layout is clean, with no jumpers. The contact fingers are gold-plated and the board is solder-masked. Sockets are supplied for all ICs. The position and designation of every component are silk-screened onto the component side; other helpful features are outlines of transistors to show orientation, and the use of square pads to indicate pin 1 of IC sockets or cathodes of diodes or positive leads of electrolytic capacitors.

The other materials are of the same quality. The electrolytics are the tantalum type, and the 14-pin and 16-pin sockets have gold-plated contacts. The 24-pin sockets for the EROMs supplied in my kit were not gold-plated, but were of good quality and presented no problems at all either while soldering them to the board, or when time came to insert EROMs.

ASSEMBLY

Checking and parts identification are easy tasks. The parts in each of the five numbered packages are listed in ascending order of designation, and the list shows the quantity, value, and color-coding of each part. In addition a full parts list in strict alphanumeric order of designation is included.

Assembly instructions are very good. It is refreshing to find a thoroughly professional piece of documentation which says all that needs saying clearly and directly. The writer obviously regards language as a precision tool to be respected. He considers a good document as an indispensable part of a good piece of equipment.

With the aid of the instructions, I was able to complete assembly in two and a half hours, clean-up and inspection in twenty minutes, voltage checks in ten minutes, and IC insertion (3 EROMs, 16 other ICs) in twenty minutes.

Particular attention is paid to the area round the 55V programming voltage generator and switching circuits, where components are closely spaced and mounted vertically; for this area an enlarged drawing is supplied, on which the component designations and orientation are highlighted.

The only instruction with which I disagree is the direction to insert all of the vertically-mounted components in the board before soldering. I tried this with one row, and found that after bending the leads slightly to keep them in place, the forest of spikes on the solder side made it difficult to place the iron at the angle I wanted. I inserted the remainder one at a time, double-checked the value and placing, and soldered and cut the leads before going on to the next.

TESTING AND OPERATION

The testing and operating section of the manual is again clear and very informative. I experienced no problem in performing the voltage checks; indications were all within the specified tolerances. All the EROM positions allowed a successful memory dump from the monitor chip. A failed 74LS20 gate delayed my testing of the *write* capability, since it triggered the programming voltage whenever the board was addressed in the unprotected mode. A call to Mountain Hardware clarified the function of one gate about which my knowledge of the S-100 bus was inadequate to explain. I then had no problem finding the failed chip with a logic probe and replacing it in five minutes. The theory section of the manual gives a good general picture of how the circuits work, and is normally quite adequate. However, for trouble-shooting involving timing, you need detailed information on the S-100 bus signals from the Altair or IMSAI manual — or a telephone call to the manufacturer will get you help.

ERASING AND PROGRAMMING

The extra EROMs that I bought with the board came filled with FF, presumably left over from the manufacturer's test. I had some trouble getting them erased. None of the computer stores in the city had an eraser, and the two club members I thought of were both away. When I tried to buy a UV tube and ballast, electrical supply stores either looked totally blank or demanded a

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parts number with which to order one, suggesting delivery time of six weeks. Neither did lamp catalogs produce information. Eventually I took the advice of the PROROM manual and contacted a Byte Store twenty miles out of New York; I was lucky, and secured what seems to be the only eraser within a 60-mile radius of the city. To avoid similar frustration, I suggest that you get your eraser — or have your EROMs erased — before you start construction of the PROROM. Also, if you know the parts numbers of suitable tubes, tell your local club.

The ease of assembly tells you something about the creativity of the design and the solid production experience of its designers.

Once this obstacle was overcome, I erased my EROMs, plugged them into the board, put the board into the system, and assembled the first routine: a tape loader for my 2K monitor, which was set up to jump to the monitor on completion of the load. The assembly was clean, so I opened the protect switch and started the assembly over. The address lamps progressed steadily up the programming area, interspersed with wild flashes from the assembler activity; when it stopped, I re-protected the PROROM board, then dumped the contents of memory where the loader should be. Immediately it was all there, no errors, ¼-second per byte for the programming. It was as easy as that! In fact, care must be taken never to unprotect the PROROM unless you actually wish to program, because any operation that writes into the EROM area will burn a byte if the board is unprotected. A single byte, for example, can be programmed by using the Examine/Modify command of a monitor. The PROROM monitor has special survival routines that do not allow its own commands to write over the monitor area; however, it was not possible to protect against a write from user software.

To get so complex a board going so easily tells me many good things about the creativeness that went into its design and the solid production experience that went into its layout and engineering.

ADDRESSING

The board can be switch addressed at any multiple of 8K; if it is not fully populated, you can switch-select the EROM area for either the upper or the lower half of the 8K segment. The only restriction is that if you use the monitor supplied, the board must be addressed for A000 through BFFF. Other switches allow 0, 1, or 2 *wait* states (0 is normal for the EROMs supplied). The DIP switch module is located at the top rear of the board where the switches are easily accessible and the markings clearly visible.

MONITOR

The monitor is as good as one could expect within the 512-byte limitation, and far better than many other "small" monitors which use more memory. It talks hexadecimal, and has the BASIC commands Display, Examine and/or modify, Transfer a Block, and Go To, with some variations on each. A source listing is not supplied unless specially ordered ($3.50), but the manual lists the addresses and requirements of a number of utility subroutines that can be called by user-written programs.

A GIANT STEP TOWARD PORTABLE SOFTWARE

The monitor on this board has one outstanding

feature that should be widely publicized: it uses the convention that the Console should be on ports 0 (status) and 1 (data) — which is perhaps the *only* convention that exists in the hobbyist software field! It is otherwise device-independent. An ingenious routine allows the user to insert the status bit polarity, Data Available status bit, and Transmitter Buffer Empty status bit of his system into the first three locations of the on-board RAM, after which the start is at location BC0C. I used it with a MITS 88-2SIO board, and therefore had to key in a few instructions to initialize the ACIA, followed by a jump to BC0C. It worked like a charm. If you happen to use a Pro-Tech 3P + S interface board, start at BC00 and the appropriate status information is automatically inserted for you. This is the first attempt that I have seen to make monitor software (and particularly PROM software) easily adaptable to any system that the user may have. It is an example that should be followed, at least by hobbyists. I can understand, though I deplore, the attempts of large manufacturers to lock you into their own hardware system by designing inflexible software. However, one of the joys of being a hobbyist is that you can swap good ideas freely, and this I/O trick is one of the ways to make software swapping very much easier.

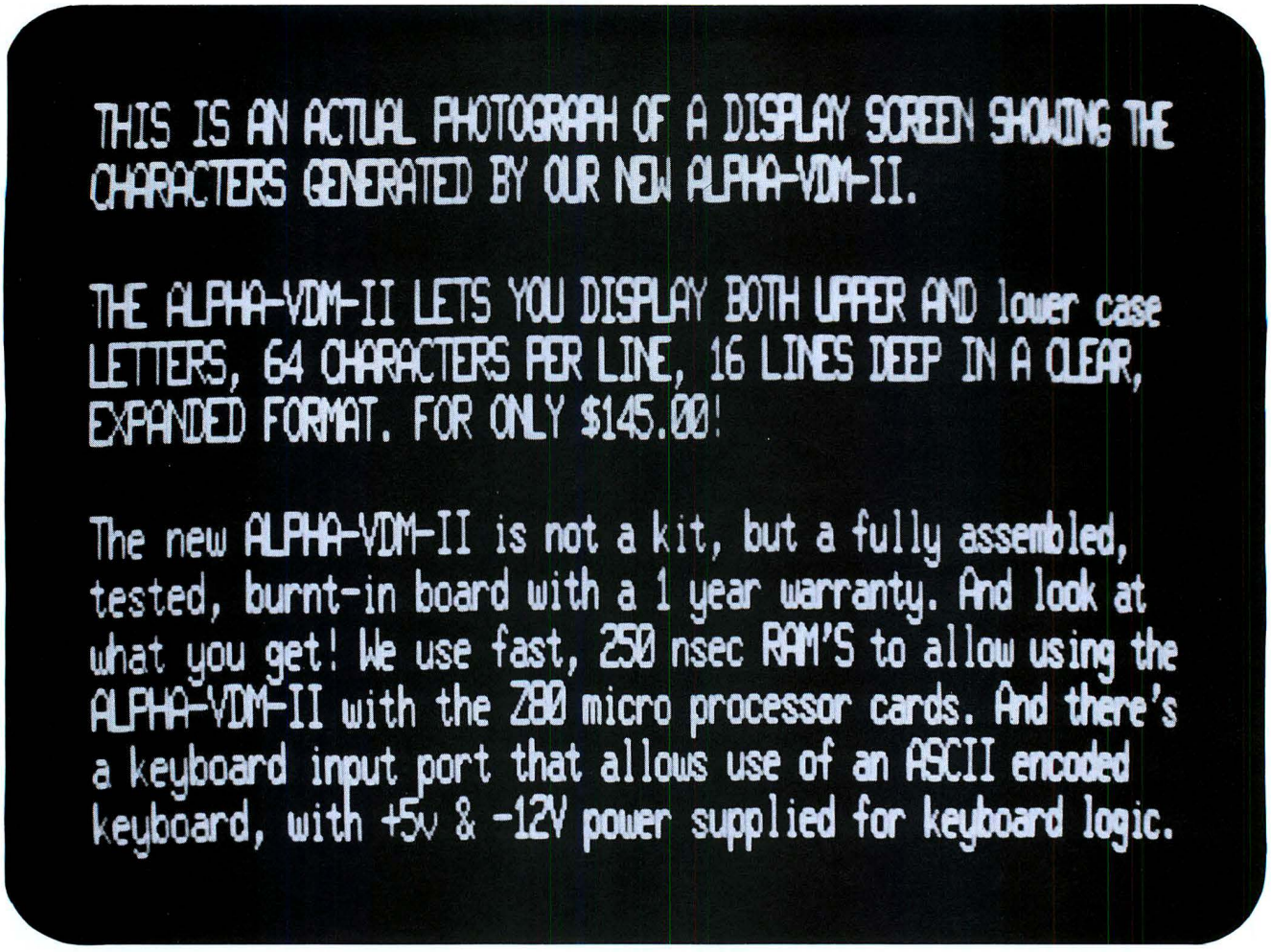
FOOTNOTE

The PROROM kit has a capacity of 7.5K EROM, 512 bytes RAM, with PROM burner built in. Plugs into S-100 bus, and has Burn/Protect switch. Programming voltage is generated on the board. Kit supplied with one 512-byte EROM (6834) (containing Monitor) and 256 bytes RAM (35391). The Monitor can be used with *any* I/O board. Price is $164, extra EROMs $19 each. Mountain Hardware, P.O. Box 1133, Ben Lomond, CA 95005.

THE FEBRUARY ISSUE WILL FEATURE AN INTERNATIONAL SPECIAL

Readers from Britain, Europe, Eastern Europe, Japan, South Africa, Australia, Latin America: We are seeking articles on your experience in microcomputing for home and professional use. Hobbyists and professional small system users are invited to share their problems and solutions with our readers.

For those of you who can read English, but have not yet tried writing, make an attempt. Outline your article in the same manner as you would in your native tongue. Keep your sentences short; use graphics and photos whenever possible. Type your text neatly double-spaced on letter-size paper. Do not be concerned about your language inadequacies. We'll polish your text before publication. The deadline for the February issue is December 25, 1977.



The Alpha-VDM-II contains 1K (1024) bytes of random access memory, to which the processor can read or write, just as though the memory were an integral part of the system. As the information is written, the contents of this on-card memory are displayed instantly without interrupting the operation of the processor.

All timing required to generate a standard video signal is provided by a crystal oscillator and associated digital circuitry. Centering of the display on the monitor screen is controlled by drift-free counter logic.

The 1K by 8 static display memory buffer is directly addressable as RAM on the S-100 bus. Displaying data on the screen is accomplished by moving the data to be displayed in the first 512 bytes of the Alpha-VDM memory. Therefore the display update is essentially instantaneous. Output routines can make use of all Memory Reference instruction, including one byte moves. (i.e. MOV M, reg.)

Multiple programmable cursor circuitry is built in. All 1024 cursors can be displayed at one time, and anywhere in the display. Thus, the VDM can display white-on-black or black-on-white — perfect for many video games! The VDM also features EIA Video output for any standard video monitor, or a TV repair shop can easily modify your own set.

The VDM comes with free terminal mode software, designed for teletype replacement. Options include select blinking cursors, text line blanking after carriage return.

Also available: 4K RAM; $107.00, 8K RAM; $197.50, 8K(Z) fast RAM; $217.50, Alpha-VDM; $107.00, Graphics-VDM; $137.00.

Order direct, by check, BankAmericard or Master Charge (Add $1.50 shipping, credit customers give us all the card numbers, please and Ohio residents add 4½% sales tax) or contact us for more information. Kent-Moore Instrument Company, a subsidiary of Kent-Moore Corporation (founded in 1919), P.O. Box 507, Industrial Ave., Pioneer, Ohio 43554. (419) 737-2352. Or, Kent-Moore of Canada, 246 S. Cawthra Rd., Mississauga, Ontario L-A3P2, Canada.

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Make the Tarbell Cassette Interface Operational

By James R. Schmidt

Most low-cost cassette recorders utilize a condenser microphone input into the recorder and lack auxiliary inputs. This common configuration presents several problems to the computer hobbyist. First, the T²L interface level must be reduced in amplitude to less than 30 mv, i.e. that of the condenser microphone. Second, the tone control is often common with the microphone on-off switch, whereby ambient noise may be modulated with the input data. To eliminate these problems the output section of the interface board may be modified as shown in Figure 1. The 1K pull-up resistor was added to reduce output level dependency upon the characteristics of the output gate. R10 and R11 were then chosen to provide an acceptable level to drive a recorder with an auxiliary input. The 220K resistor attenuates the digital signal to an acceptable level for the condenser microphone input/ALC circuit. The capacitor in parallel with the 220K resistor was added to accent the high frequency content of the digital signal into the cassette recorder. Since condenser microphones require a D.C. bias for operation, the built-in microphone was disabled simply by disconnecting the bias supply at the switch mounted on the tone control. Now that the cassette recorder is capable of reproducing an acceptable copy of the input, the Tarbell board may work.

The intent of the circuitry associated with the non-inverting input to the 8T20 comparator is to add a small amount of hysteresis to the input detection circuit to improve noise immunity. The problems associated with the input are twofold and directly related. The assumption that the output of the recorder will be an exact duplication of T²L levels from the cassette interface implies that a logic one will be greater than 2.4 volts and a logic zero will be less than 0.4 volts. Thus the mean level is 1.4 volts as shown in Figure 2. Resistors R1 and R3 shift the hysteresis bias level to 1.4 + 0.5 volts when CR1 is reversed biased. R2 was changed to provide a hysteresis bias level of 1.4 − 0.5 volts when the diode is forwarded biased (Figure 3). With this modification all spurious responses within the limits of 1.4 ± 0.5 volts will be rejected. In order to insure operation the inverted input to the comparator must be biased to 1.4 volts. Although this is the intent of the Tarbell interface, it requires the reference circuit of the 8T20 to be at its nominal value.

The Signetics specs note a maximum of 2.0 volts and minimum of 0.8 volts which will render the circuit non-operational. (In accordance with Murphy's Law mine was 2.0 volts.) To correct this problem Ra and Rb (Figure 4) were installed to provide the proper bias level and decoupled via Rc. With these modifications reliable operation of the Tarbell cassette should ensue.

The reliability of data transfer can be further improved by using a reel-to-reel or cassette deck. The deck offers the advantages of no ALC circuitry present to cause distortion, level monitoring of the recorded signal, improved frequency response, improved speed stability, a counter, higher input levels for noise immunity, and power line isolation. Most important is cost; you probably have one for your stereo system.

Since the typical "line" output level of a deck is 1 Vpp, an amplifier is required to produce amplitude sufficient to drive the 8T20 with its hysteresis bias. I chose to use a LM3900 because of its single ended low voltage supply requirements and 50¢ cost to provide the amplification. For a minimum input of 1 Vpp, I wanted the OP amp to produce its maximum output. Since the LM3900 maximum output clamps at V_{CC} − 1.0V, then the gain had to be on the order of 4-6. With the circuit of Figure 5 any input over 855 mv clamps the output of the LM3900 at 4V.

Since the hysteresis of the 8T20 is set up for a center of 1.4V (T²L signal levels), pin 6 should swing between 2.8 and 0 V. Noting that the differential impedance of the 8T20 is 2K, R103 was calculated to be 1.25K. The circuit of Figure 5 in conjunction with soldering wires in all the "plated thru holes" of the Tarbell board and using a reel-to-reel recorder has produced a unit of high reliability.

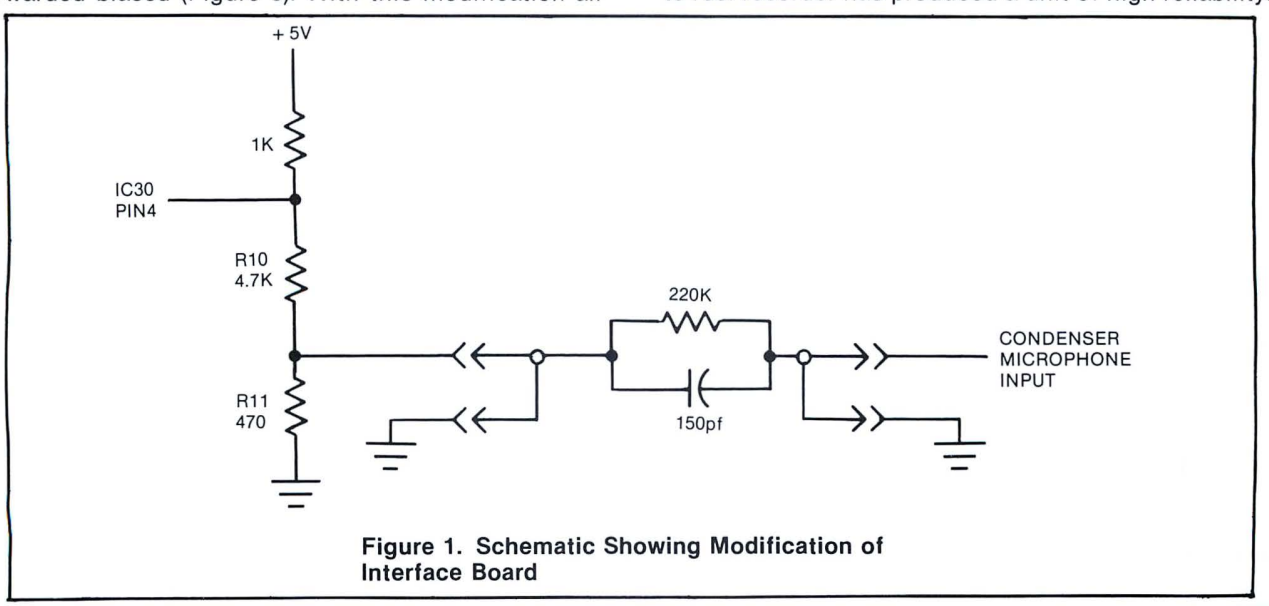


Figure 1. Schematic Showing Modification of Interface Board

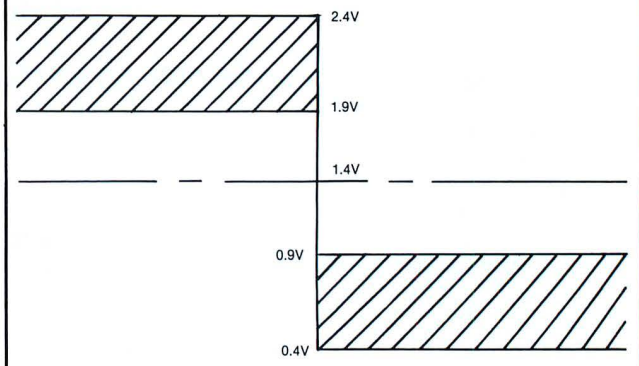


Figure 2. Mean Voltage Level

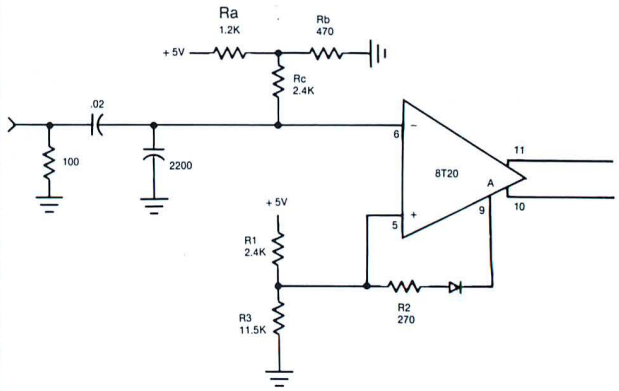


Figure 3. Forward-biased diode changed to provide hysteresis level.

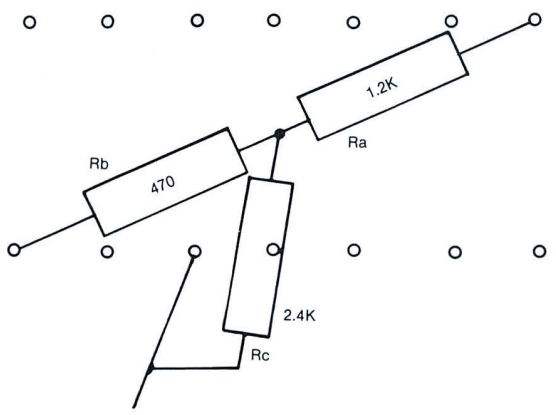


Figure 4.

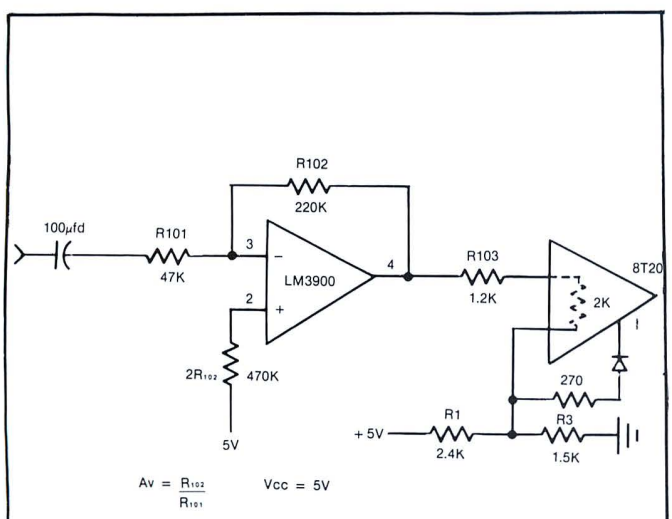


Figure 5.

UP YOUR TERMINAL

By W. Fred Kennedy
Chesapeake Microcomputer Club

Owners of the Burroughs Model 9350-2 terminal know that it is indeed beautiful equipment, but putting it into service with the average computer poses some very sticky problems. The problems can be approached through *special software* to provide the line protocol demanded by the machine, but this will never provide a true, immediate response nor conversational mode of operation because of buffer delays. The software required is also extensive to say the least and, of course, will be different for every type of CPU on the market now or in the future.

I chose to solve the problem through hardware modification. This has provided very satisfactory results, though a great deal of time was spent tracing and studying the unit to find everything needed to develop the modifications (mods). The mods themselves are relatively simple; a UART (Universal Asynchronous Receiver(Rx)/Transmitter(Tx)) IC is used with five other common TTL ICs to do the job.

Before describing the mods, I would like to discuss a few points which I feel are helpful to the project.

It's good, though probably not necessary, to start with a known sound unit. An ASCII keyboard was used with a UART to test the prototype at its design baud rate of 150. It was found to respond perfectly to all the control codes used in the scheme of protocol, i.e. DC-1, DC-2, ACK, NAK, ETB, ETX and the special LRC code.

If anyone wishes to use the machine with a parallel interface to a computer, the mods can be somewhat simplified, although some sort of handshaking circuits will be required. This is not discussed here. I chose TTL level serial I/O because I wanted to talk to two home computers, both with TTL level serial I/O, and to a TTL level Modem and Tape Recorder. The latter, incidentally, is *extremely* useful in testing the unit. Most modern computers (and others) with serial I/O transform to TTL levels at some point in the circuit. These points (i.e. Tx and Rx) can usually be easily accessed. With the situation described above, there is no reason to use RS-232 voltage levels or Teletype current levels. Circuits are available for interfacing either or both, but they are beyond the scope of this article.

One of the computers used with the terminal is an M6800 microprocessor which employs MIKBUG*, a software UART, loader and diagnostic program — a *beautiful* piece of firmware. Since tabs (HT) and carriage returns (CR) on the Burroughs terminal are slow, the standard Teletype serial bit-stream pattern of 110 baud, 10 characters/sec was chosen — primarily to slow down data flow. For example, when MIKBUG sends a CR, it also sends a line feed, a DC-4, and three NULLS to allow time for the CR function to be completed before it types its characteristic.* Approximately 60 characters can be typed on a line using MIKBUG delays without loss of data caused by CR's. This is more than adequate for MIKBUG functions. If longer lines of type are needed, additional delays can easily be provided by software.

I developed a numbering scheme to systematize tracing and to document the mods. With the control box main cover removed, stand the unit on a table so that the cards can be seen on upper left, connectors to card reader and printer on upper right and power supplies on lower right. Cards are numbered #1 through #13 from left to right. Pull any card except #7 and #8 (these two cards do not use ICs). Hold the card with edge connector *up* and with IC tops facing the observer, then;

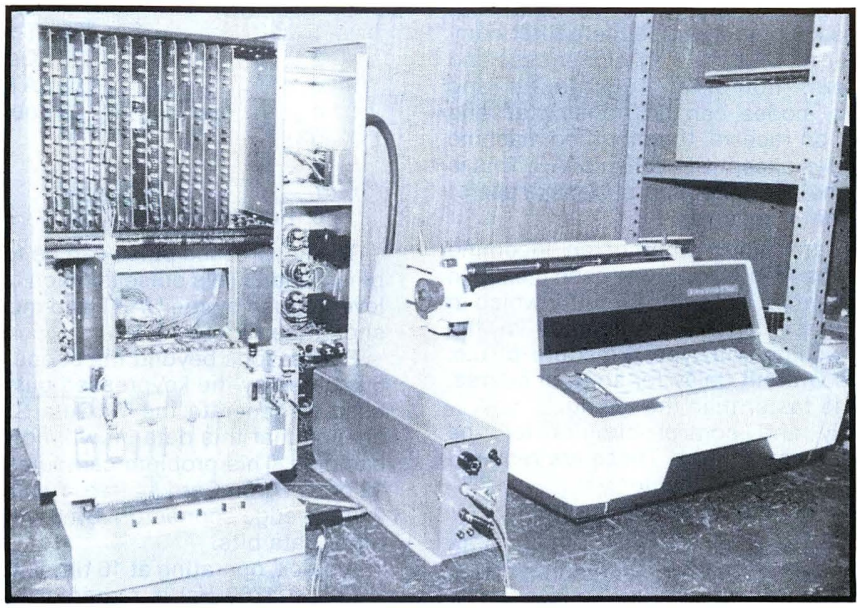
CONNECTOR PINS: (Note some cards are marked this way)
Pin 1 through pin 40 run left to right on *back* of card.
Pin 41 through pin 80 run left to right on *front* of card.

I.C.s:
Rows are lettered A, B, C, D, etc. from top to bottom
I.C.s in each row are numbered 1,2, 3, etc. from left to right and spaces are *not* counted. All ICs use *standard* 14-pin numbering.

The mods will not be presented in "Heathkit" form. Some reasonable experience with electronic circuitry is essential. Furthermore, only essentials will be given. As an example, such things as pin connections on the mod board are purely arbitrary and will not be specified. It will help if the individual who implements the mods is the type of person who can "figure things out." Several minor problems were encountered with the typewriter.

The modifications to be described actually involve *only the control box.* The question may arise as to why this large, cumbersome box was retained for use. The answer is simple. While it is certainly possible to make the typewriter alone fit into a mod of this sort, the following facts dictated the use of the control box:

*Motorola MCM6830L7 ROM of the M6800 series of components



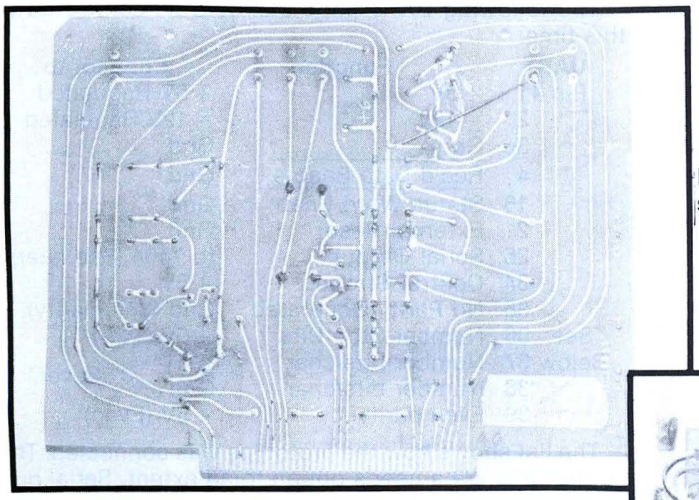


PHOTO 1. Time-out mod on Board #7. Note jumper strapping test point to ground.

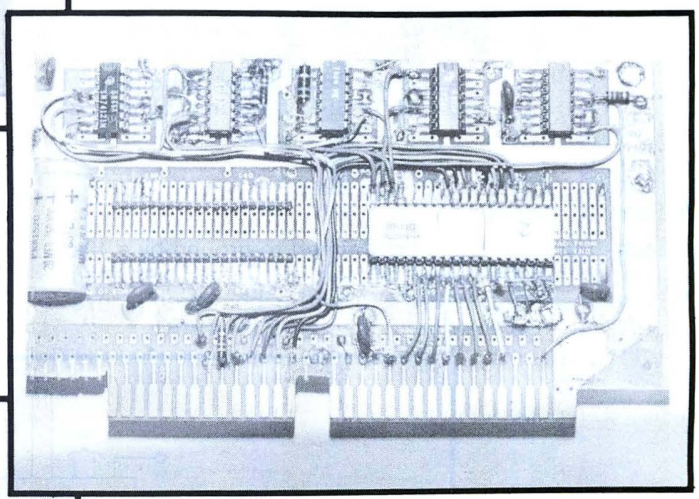


PHOTO 2. Prototype board containing UART circuitry.

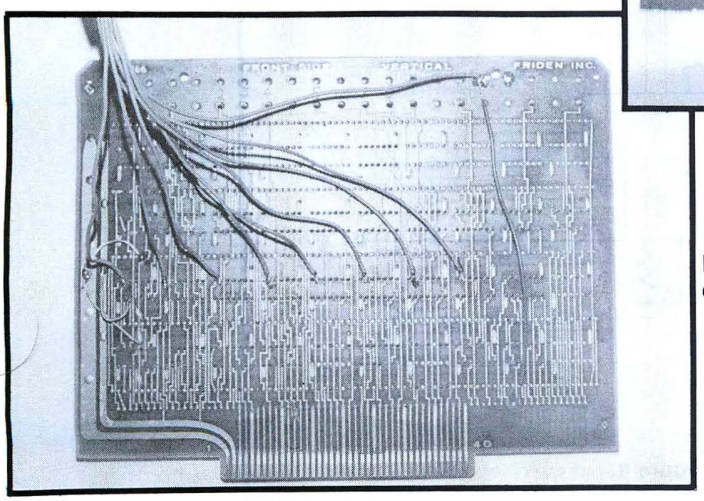


PHOTO 3. Fully encoded ASCII parallel data is brought out from Card #4.

A. Keyboard data is *not* fully encoded in the typewriter. The mod accesses keyboard parallel data after complete 128 character ASCII encoding. Upper case and lower case letters, numbers, punctuation and (almost) all control codes can be transmitted and received although, on receive, the modified machine ignores control codes except CR, SP and TAB. This is not a problem — the computer can still make use of *all* control codes that it receives.

B. The logic which determines whether an incoming character is upper case (u.c.) or lower case (l.c.) is in the control box. The mod uses this circuitry which in turn actuates the u.c. and l.c. solenoids in the typewriter. The machine will type a mixture of u.c. and l.c. characters without delay for shift, of course, because the shift is faster than the typing.

C. The power supply and control circuits for the typewriter are in the control box. These are required for proper operation of the typewriter.

D. Power for the mods is taken from the control box.

Please note that the mods, as presented here: (1) do *not* provide for the use of the card reader, and (2) completely bypass the delay line memory which is a part of the original terminal.

Before proceeding with the Tx and Rx mods, the time-out clock should be disabled by grounding the green test point on board #7. Even the software troops, who choose to pacify the machine with line protocol, will like this.

If the reader has a proto-board, he may wish to "lash-up" the mods experimentally before implementing a hard-to-change, final design. This is certainly recommended.

MODIFICATION FOR TRANSMIT MODE OPERATION

Fully encoded ASCII parallel data is brought out from Card # 4.

Data Bit #	IC	IC #	Comments
1	Pin #2	B8	Bring leads out to
2	2	B7	added edge con-
3	2	B6	nector. Bit 8 is not
4	2	B5	used in the proto-
5	2	B4	type.
6	2	B3	
7	2	B2	
Optional 8 (parity)	2	B1	

Each data line should be **shunted** to ground by a 10k resistor to reduce signal voltage to slightly less than +5V for use by the UART (Control box circuits use +6V). Data lines then feed directly to the UART:

Data Bit #	UART	Comments
1	Pin #26	The UART used is a
2	27	General Instrument
3	28	AT-5-1013 (A), available
4	29	surplus for about $6.00.
5	30	
6	31	
7	32	
8 if used	33	

The keypressed pulse can be found on Card #4, IC A7, pins 1 and 2. This pulse is much too wide and too high in level for use by the UART and must be shaped by a one-shot. (See Figure 1.)

For reasons beyond the scope of this article, data bit 6 is gated by the keypressed pulses. Since this pulse is used to generate the Tx Data Strobe pulse, there is a chance that this data bit will not be up and ready when sampled. This problem can be alleviated by cutting pin 12 of IC B1 on Card #4 free. *Jumper* this pin to +6V (pin 2 of the edge connector). Bit 6 will now come up with the other data bits.

A clock, operating at 16 times the serial bit rate (i.e. 16 x 110 = 1760 Hz) is required for Tx and Rx. A recommended, self-starting circuit is given. (See Figure 2.)

The following UART pin #'s should be connected at this time:

UART	Function	Connect to
Pin #1	+5V	+5V Regulated
2	−12V	−12V Regulated
3	Gnd	Gnd
4	Rec'd Data Enable	Gnd
16	Status Word Enab	Gnd
21	External Reset	Gnd
25	Serial Output	to 7404 (See later)
34	Control Strobe	+5V
35	No Parity Generated	Gnd (Yes, parity)
See 36	Number Stop Bits	+5V (Two)
Below 37	Number bits/char	+5V \ (Seven)
38	Number bits/char	Gnd /
39	Even parity	+5V (Even)

The list shows how the prototype was connected. The control bits are a user's option to an extent. Serial output from the UART should be buffered (See Figure 3.)

MODIFICATION OF POWER SUPPLY

Looking into the power supply with the control box oriented as described earlier (i.e. power supply lower right), three large electrolytic capacitors will be seen. To obtain +5V and −12V for use by the mods connect as indicated. (See Figure 4.) These are *add-on's.* The unit's power supplies are to be left intact.

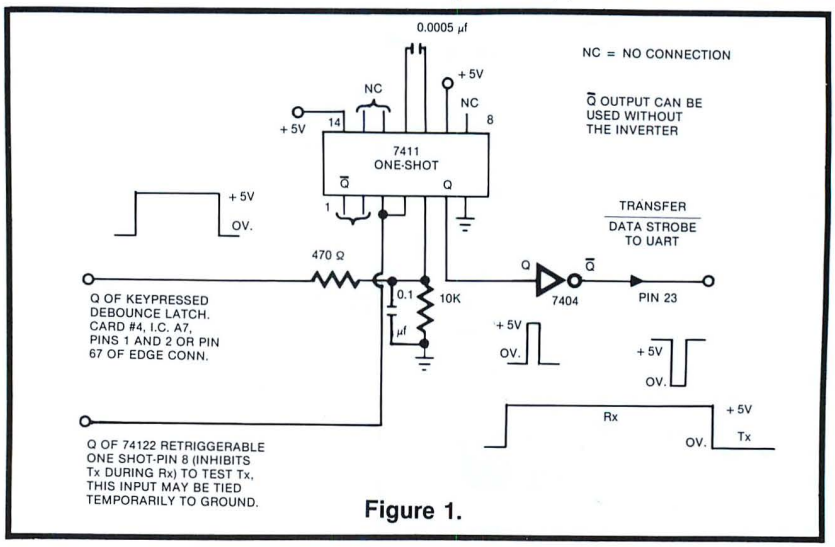


Figure 1.

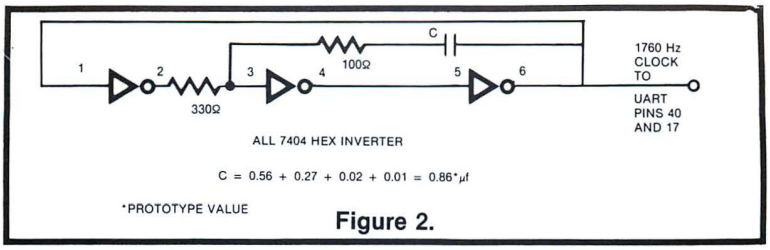


Figure 2.

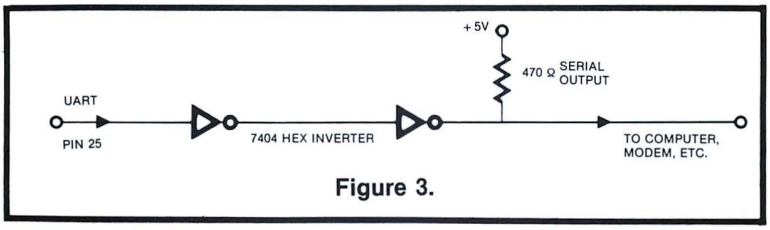


Figure 3.

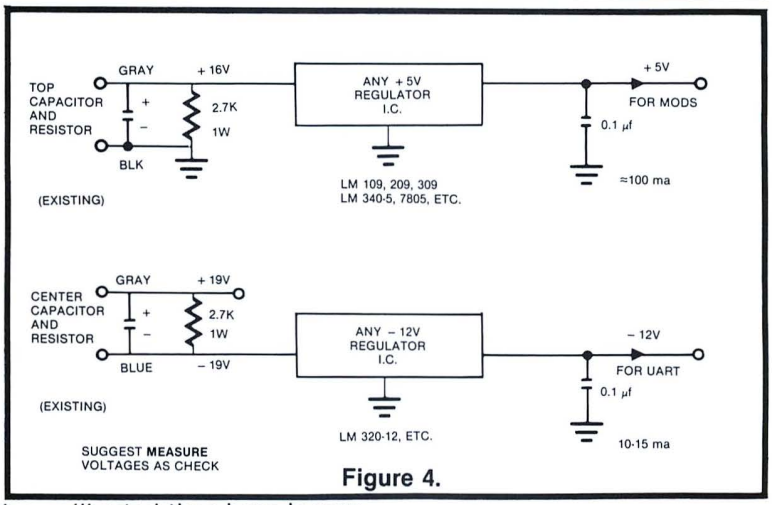


Figure 4.

A triggered scope with a calibrated time base is very useful in setting the baud rate (bit rate) and in checking bit patterns. Adjust C of the clock to obtain the desired rate. If the serial bit stream is set up the same as in the prototype, it will look like Figure 5 on a scope.

MODIFICATIONS FOR RECEIVE MODE OPERATION

Serial input to the UART should be buffered. (See Figure 6.)

Received (parallel) data bits will appear on UART pins 5 through 12. These are to be connected to the Control Unit as follows:

Data Bit #	UART		Card Reader Connector	Card #2 Connector	Card #4 Connector
1	Pin #12		Pin #11	Pin #76	Pin #35
2	11		12	39	37
3	10	Connect	13	63 OR	29
4	9	To	14 OR	43	21
5	8		15	45	19
6	7		16	42	14
7	6		17	46	53
8 Optional	5		18	—	48

Note: If the UART control bits are connected as in the prototype, bit 8 (parity) will not be present here. The typewriter does *not* use parity. TTL levels work fine into the DTL circuits of the control box. The UART is not overloaded with these inputs.

A read pulse, $\overline{\text{(Received Data Strobe)}}$, to be used by the Control Box, is generated in this manner. After a received character is shifted in and transferred to the buffer in the UART, the Data Available line (UART pin #19) goes high. This signal is used to trigger a one-shot. The output of the one-shot does two things. it is used; (1) to reset the Data Available flip-flop in the UART (UART pin #18) and (2) as a read pulse to transfer received parallel data into the control box for typing. (See Figure 7.)

The card reader inputs must be enabled in print mode by connecting pin #8 of I.C. B5 on card #13 to ground.

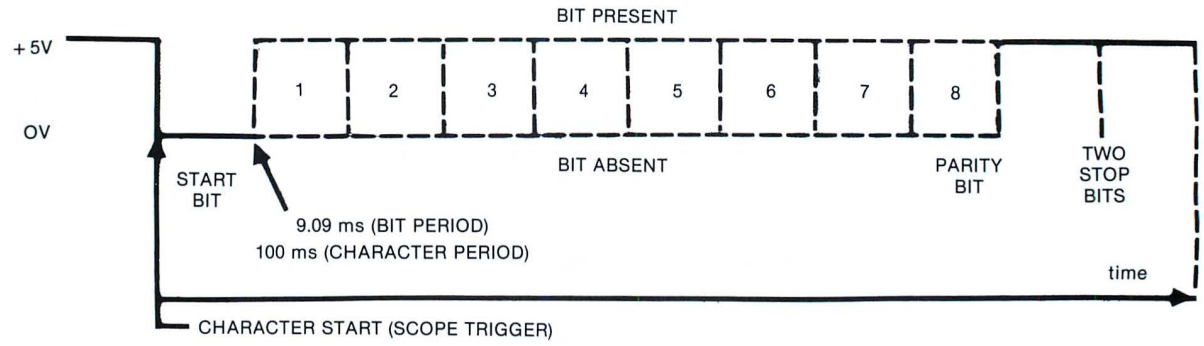


Figure 5.

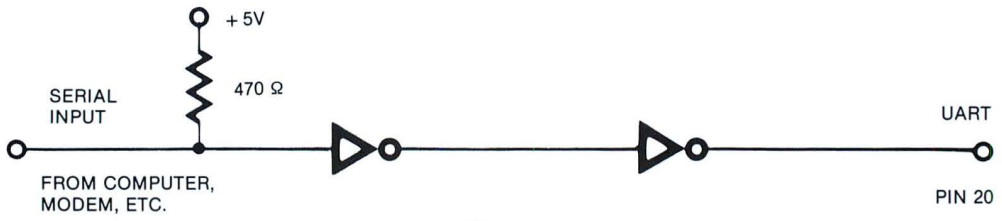
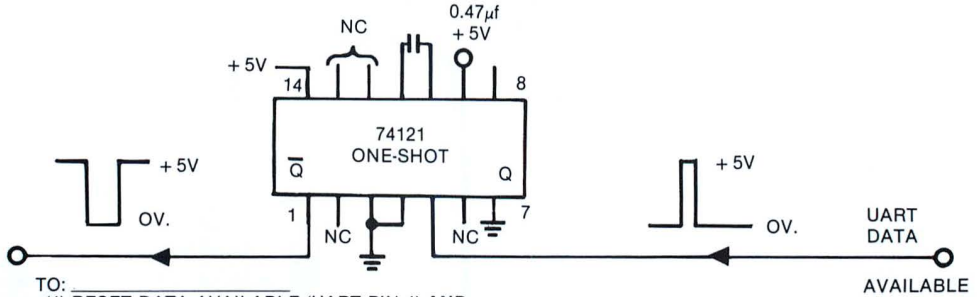


Figure 6.



NOTE: IN THE TEXT, A BAR APPEARS ABOVE CERTAIN FUNCTIONS (e.g. $\overline{\text{RESET DATA AVAILABLE}}$, ABOVE). THIS IS STANDARD NOTATION INDICATING THAT THE FUNCTION IS "ACTIVE LOW" (i.e. WITH POSITIVE TTL LOGIC, OV.)

Figure 7.

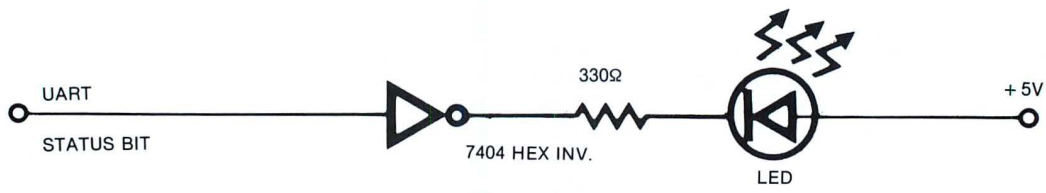


Figure 8.

The UART status bits can be connected to LEDs, if desired.

UART	Function	
Pin #13	Parity error	
14	Framing error	(See Figure 8.)
15	Over-run error	

UART pins 22 (Tx buffer empty) and 24 (End of character) are not used.

At this point in the modification, the machine should transmit and receive, however, one very important problem and one minor one remain. Because of the mechanical construction of the typewriter, every received character will be echoed back to the computer by the transmitter since the UART is operating in full duplex. **The transmitter must be inhibited during the receive function.** This is accomplished very effectively. (See Figure 9.)

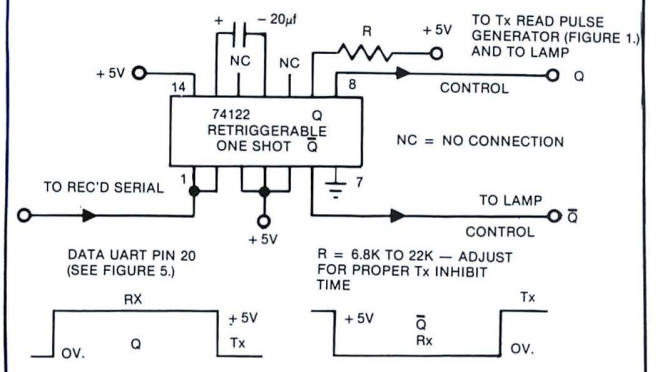


Figure 9.

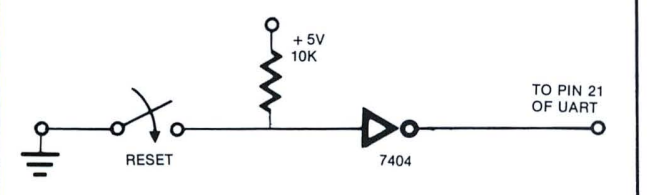


Figure 10.

The Retriggerable One-Shot (74122) has a very special property. Once triggered, it can be retriggered over-and-over again, and the ultimate return to its stable state (untriggered) will occur one gate period after its last trigger. The device is connected to sample the received data line. Any zero level condition such as a start bit or bit absence in the serial stream will serve to retrigger the one-shot. The output gate, Q, is used by the Tx Read Pulse Generator (See Tx Mod) to inhibit the Tx Read Pulse during the Rx function. **Note that a conventional one-shot will not perform this function.** Q and $\overline{Q}$ are also used to control indicator lamps.

The minor problem referred to will not appear if the machine is operated in idle (reset) mode. If, however, the machine is operated in the *original* TX/Send mode, the terminal's buffer will fill up with characters from the computer. When the buffer fills up it will interrupt typing and reset must be used to clear the buffer. The problem can be alleviated two ways: (1) Operate in idle mode at all times or (2) On board 4, cut edge connector lead #45 and ground the *board side* of the cut (connector pin #1 is

 CIRCLE INQUIRY NO. 90

ground). The latter is recommended. This keeps the delay line memory in a reset condition.

One additional mod should be implemented. On the back of the motherboard (the card socket complex), locate and label three leads from the typewriter connector as follows:

Card #	Edge Connector	Connector	Function
12	Pin #72	Pin #50	Rx mode indicator lead
12	21	52	Tx mode indicator lead
2	5	53	Send mode indicator lead

After labeling remove these wires from the sockets (they should pull off) and connect the wires, not the socket pins, as follows:

Rx mode indicator lead — connect to 74122 $\overline{Q}$

Tx mode indicator lead — connect to 74122 Q

Send mode indicator lead — connect to 74122 Q

This enables these indicator lamps in the modified typewriter to show Tx/Send and Rx status.

When connecting wires to the card sockets, *female* pins, which have been removed from the same type of connector used for Input/Output by the original terminal, will fit nicely over the wire wrap pins of the card sockets. If wires are removed from card sockets, it is strongly advised that the be first labelled carefully. There is no need to disturb wire wrap leads.

Connector leads to the card sockets (all white in the prototype) often connect to more than one socket. If they do not appear on the indicated pins, they may be plugged onto another socket and connected by wire wrap leads. If this is encountered, a little tracing with an ohmeter should straighten it out.

Now a couple of afterthoughts. None of these mods will impair the original circuits. If desired, the original form can be restored by "undoing" the mods.

The implementor of these mods may discover that several of the original cards can be pulled without affecting the modified terminal. This is OK, but it is suggested that power supply voltages in particular, and performance in general, be monitored carefully if and as this is done. I had not done this permanently at the time of this writing.

The 470 ohm pullup resistors used on the serial data lines may not be necessary. They were used in the prototype because an occasional transient of obscure origin caused an erroneous character to be transmitted or received.

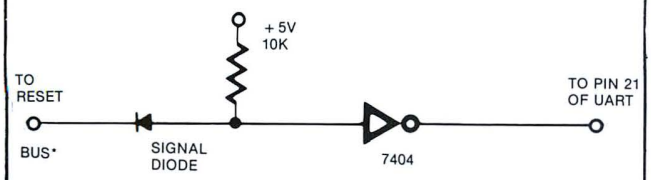
The modified terminal should be operated off-line with reset actuated.

Anyone who implements these mods should study and understand them before starting to modify. It is highly advisable to "test as you go." The prototype machine showed signs of minor mods when purchased. There is no guarantee that all machines are alike or in the same state of repair. If help is needed, you can contact me through the Chesapeake Microcomputer Club, Inc., 236 St. David Court, X4, Cockeysville, MD 21030.

HINDSIGHT COMMENTS

In the prototype a General Instrument AY-5-1013 (A) UART was used. This does not require an external reset before it will operate (Note that pin 21 is grounded). Unfortunately, some other pin compatible UARTs do require an external reset. This can easily be accomplished with a S.P.S.T. normally open, pushbutton switch and one of the spare sections of a 7404 hex inverter. See Figure 10. A nicer approach is to connect this to the existing typewriter reset bus. See Figure 11.

Some typewriters require more energy than the prototype in the read pulse generated in Figure 7. This can be provided by increasing the value of the 0.47 μf capacitor. In the case of two other machines, a value of 4.0μf was required. If the modified machine skips characters this should be checked.



*THE RESET BUS CAN BE ADDRESSED SEVERAL PLACES; PRINTER CONNECTOR PIN 38, AND THE FOLLOWING CARD EDGE CONNECTORS:

CARD #	PIN #	
1	73	
2	54	THE RESET
3	12	BUS PULLS
4	45	UP TO +6V.
5	20	THE RESET
6	46	SWITCH CROWDS
10	54	THE BUS.
11	62	
12	24	
13	4	

Figure 11.

In the text a green test point on board #7 is referred to. As fate would have it, this test point in many machines is white. To be sure that the proper test point is located, place board #7 on a table with the back side (the side without any components) up and with the edge connector toward the observer. The test point is the second from the right. As a further check, this point ties directly to the collector of a transistor which is one of two used in a free-running multivibrator circuit.

TESTING AFTER MODIFICATION

A very useful test of the machine can be made by connecting the serial output to the serial input and typing (quickly) a single, printing character. The machine should print a second character, hopefully the same. The TX/Send and Receive lights should also function during this test. Remember, the machine is inherently a half-duplex device and is forced to receive mode any time a character appears on the serial input line.

Many full duplex machines require loop-back (echo of the serial output back to the serial input) to function properly. This machine does not need or want this and, if provided by the associated computer, it should be disable, if at all possible. If echo is provided by hard wire, e.g. with MIKBUG, the circuit can usually be disabled with a board cut and/or *jumpering*. If echo is provided by firmware, e.g. The System Monitor ROM, it may or may not be possible to disable it. For example, this is a deletable option with MINIBUG II. It is evidently not deletable with the Technico T.I. 9900 Monitor ROM.

The use of a good oscilloscope with a calibrated time base is highly recommended in checking out the machine. Either this or a frequency counter may be used in setting up bit rate. The latter becomes particularly important when test typing from someone else's cassette tapes. Needless to say, the bit rates must match closely since bit synch is not used.

When using A.C. powered test equipment the user should be extremely cautious with ICs — particularly the UART. Be absolutely sure that a good ground connection is used between equipments. Test probes with large isolating resistors are also to be preferred.

Solder all connections neatly and carefully with a hot, low wattage iron employing a grade of solder intended for use with microcircuits. Excessive resin, which may contain particles of carbon, tiny beads of solder or other contamination can prevent a UART from working.

I am quite interested in how the implementation of these mods is proceeding. Share your experiences with us by contacting us through the magazine or the club.

```
L
S1Ø5AØ48ØØ15FD
*
S113ØØØØFFAØ4ACEE19DC6Ø6A6ØØBDE1D1Ø85A264E
S113ØØ1ØF7FEAØ4A398DE9CEØØ8ØBDEØ7EBDE1AC9B
S113Ø02Ø81ØØ27F1813A2AØ981302BØ58DD2Ø82ØDD
S113Ø03ØE98DCDFFAØ4ACEØ1EABDEØ7EFEAØ4A2ØB4
S113Ø04ØDCDCDF76F5FFFDFE93FADCEEF2FFF762ØF
S113Ø05ØDE7FD99EF77CDEF4D7F7FEF2CB7F74EE19
S113Ø06ØB6D61FFAE3EFF5FC77BDF7DE57E3FAFCEB
S113Ø07Ø7F3F1E9AE27F67EEBFD6BDBEB61B1B5CF8
S113Ø08Ø492Ø616D2Ø612Ø636F6D7Ø757465722EF7
S113Ø09Ø2Ø492Ø616D2Ø7468696E6B696E672Ø6FFA
S113Ø0AØ662Ø612Ø6E756D6265722Ø66726F6D2Ø2C8
S113Ø0BØ3Ø2Ø746F2Ø392E2Ø5472792Ø746F2Ø6799
S113Ø0CØ756573732Ø69742EØDØ4596F752Ø6775F7
S113Ø0DØ65737365642Ø77726F6E672E2Ø5472792E
S113Ø0EØ2Ø616761696E2EØDØ4596F752Ø6775650F
S113Ø0FØ737365642Ø77726F6E672Ø616761696EEØ
S113Ø1ØØ2C2Ø4554D4D592121Ø2547279Ø2Ø61678A
S113Ø11Ø61696E2EØDØ4426F79212Ø596F752Ø722A
S113Ø12Ø656161C6C792Ø61696E27742Ø746F6F2Ø2F
S113Ø13Ø627269676742E2Ø4F682Ø77656C6C2C36
S113Ø14Ø2Ø49276C6C2Ø747279Ø2Ø746F2Ø626520BA
S113Ø15Ø7Ø617469656E742E2Ø54727Ø2Ø616761DØ
S113Ø16Ø696E2EØDØ457726F6E672Ø616761696E48
S113Ø17Ø212121212120546861742Ø646F65732Ø3A
S113Ø18Ø69742C2Ø4E4E55434B4C4548454144 2EF5
S113Ø19Ø2Ø49276D2Ø7469726564 2Ø6F662Ø7Ø6C35
S113Ø1AØ6179696E672D2D6C657427732Ø7175698B
S113Ø1BØ742EØDØ443616E27742Ø796F752Ø726567
S113Ø1CØ61642C2Ø594F594F3F2Ø492Ø7361696461
S113Ø1DØ2Ø6C657427732Ø7175697421212121 2E87
S113Ø1EØØDØ4ØDØ4ØDØ4ØDØ4ØDØ4ØDØ4492Ø7361696 4AC
S113Ø1FØ2Ø612Ø6E756D6265722Ø66726F6D2Ø5A83
S113C2ØØ45524F2Ø746F2Ø4E424E452C2Ø4455 4D85
S113Ø21Ø4455 4D2E2Ø446F6E27742Ø747279Ø274D7
S113Ø22Ø6F2Ø757365 2Ø746865 2Ø77686F6C652Ø2E
S113Ø23Ø6368617261637465722Ø7365742121213E
S1Ø8Ø24Ø212EØDØ4B99C
*
```

Above is a MIKBUG™ memory dump of a simple, do nothing, fun program that readers with an M6800 MPU, a MIKBUG ROM and little troops may find interesting. Below is a run of the program.

```
*G
I AM A COMPUTER. I AM THINKING OF A NUMBER FROM 0 TO 9.
TRY TO GUESS IT.
7
YOU GUESSED WRONG. TRY AGAIN.
3
YOU GUESSED WRONG AGAIN, DUMMY!! TRY AGAIN.
A
I SAID A NUMBER FROM ZERO TO NINE, DUMDUM. DON'T TRY TO USE
THE WHOLE CHARACTER SET!!!!.
5
BOY! YOU REALLY AIN't TOO BRIGHT. OH WELL, I'LL TRY TO BE
PATIENT. TRY AGAIN.
1
WRONG AGAIN!!!!! THAT DOES IT, KNUCKLEHEAD. I'M TIRED OF
PLAYING — LET'S QUIT.
9
CAN'T YOU READ, YOYO? I SAID LET'S QUIT!!!!
6
```

Multivibrators

by James O. Kendrick, Jr.

Multivibrators are used in computer hardware to go from a high level to a low level. With positive logic it would be binary 1 as high and zero as low, whereas just the opposite is true of negative logic. There are three types of multivibrators: the astable, monostable, and bistable. Although it is the bistable that is of most interest to computer hobbyists, I will touch briefly on the other two.

THE ASTABLE

The astable is made up of two stages using AC coupling and each stage being phase-inverted and positive feedback coupling. This causes continuing oscillation. When Tr1 is on Tr2 is off. This will cause the base voltage of the Tr2 to reach exponentially that of the supply voltage. The collector voltage in turn will start to drop and be coupled to the base of Tr1. Tr1 will now start to turn off and an apparent rise in collector voltage will occur. Simultaneously, the base current of Tr2 will increase, reducing its collector voltage. The switching of on and off states will be completed when Tr2 reaches saturation. When designing this type of circuit it is imperative that the base-emitter be protected with high-speed diodes, and the Vcbo has to twice that or better of the Vcc. This applies to when the collector is twice the plus Vcc in relation to the base that is reverse-based.

The astable multivibrator is useful where there is a need for successive repetitive pulses such as in PCM work.

THE MONOSTABLE

The monostable vibrator operates on both AC and DC coupling. This will allow it to rest, and then to be quasi-stable by an external pulse. When the vibrator is in the quasi-stable state, the circuit is usually turned on by the input's negative edge. If the positive half of the input happens to offset the quasi-stable state, it will cause a premature resetting of the circuit. This is usually overcome by adding a diode and a resistor to the base of Tr1. It can also be overcome by coupling a capacitor-resistor from base to emitter of Tr2. The values of R5 and R1 are approximately the same. If high speed application is involved a diode is put across R5. It is interesting to note that if pnp transistors are used rather than npn, as in the above circuits, and supply voltages and diodes are reversed, the waveforms will be just the opposite.

The monostable multivibrator is usually applicable to power supplies.

THE BISTABLE

The bistable multivibrator is the one that is of most interest to the computer hobbyist. It is used in central processing unit's register as the binary counter. It can be used in memory and is the heart of all frequency counters. The bistable multivibrator is essentially an astable type except that there are two DC couplings instead of the AC and DC. The circuit switches between two different stable states, the triggering being an external pulse. The heart of the bistable is the integrated circuit. There are exceptions, though, when an IC is not used. They are when input and output conditions are such that IC compatibility would be impossible, when there is low power dissipation, when low or high speed is necessary and also involving only a simple counter. When not using the IC scheme, we will be involved with transistor configurations.

It is the IC configuration involving the concept of logic about which we shall be most concerned. The basic rule that applies to bistables is that they must have a memory, which means when the external signal has been removed they will stay in the state of that signal. This is often referred to as a flip-flop condition.

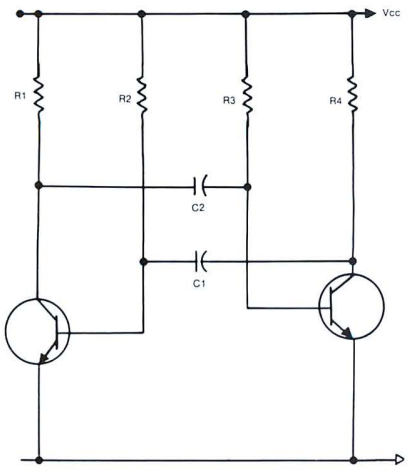
The bistable IC is classified according to its triggering level or threshold and also transient or edge triggering. The first consideration is concerned with the way the output changes when the input is at its threshold or triggering level. For example, if we were to go from a +5V input to a +15V there would obviously be a change in amplitude of the output waveform and perhaps a change in the shape of the waveform itself, which we shall discuss later. The second condition is when the clock within the IC itself changes state, often referred to as toggling.

The most often-discussed and perhaps simplest bistable or flip-flop is the R-S. It is two NOR or NAND gates that are coupled in a cross-like manner, often called latching. There are generally two inputs, the R (reset, often called C (clear), and the S (set) input. The output of the gates are called Q and $\overline{Q}$. This means that the output states are completely opposite. But when R and S are zero, then Q and $\overline{Q}$ will be one when using the NAND gate configuration. The truth table for both the NAND gate and NOR gate bistable is given in Figure 3. Figures 3 and 4 show the relationship of the R-S to the truth table. It will be noticed that the second and third lines of the table represent the reset and set input respectively. When there is a one on the set input and a zero on the reset, this will trigger output (Q) to zero, while ($\overline{Q}$) will be a one. From the table the reader will be able to discern that the direct opposite is true of line three for all conditions. The fourth line states that when there is a 1 on R of Gate 1, still using two NAND gates, and S on Gate 2 is a 1, and there is a zero on Q going to the other input of Gate 1, this ultimately has not altered the Q output from that of line three. This type of situation is truly that of a multivibrator. From the information given so far about the R-S truth table the reader will be able to make up different logic equations of his own. The complete R-S principle works on the idea of regeneration.

As I mentioned previously the subject of waveform would be discussed when working with an R-S configuration. The diagram in Figure 4 will show the type of action that is involved when a sinusoidal waveform, namely AC is applied to the input, there will be a square wave output that has a rise and fall time of approximately 10 to 15 nanoseconds. The triggering voltage of most standard gates has to be approximately one volt, which means that it is not in range of the threshold level, thus accomplishing triggering.

THE R-S-T FLIP-FLOP

The next member in the family of bistables is the R-S-T flip-flop. The T in this case denotes toggle or triggering terminal. It is this type that belongs to the edge-triggered classification. It will change condition or state up-going



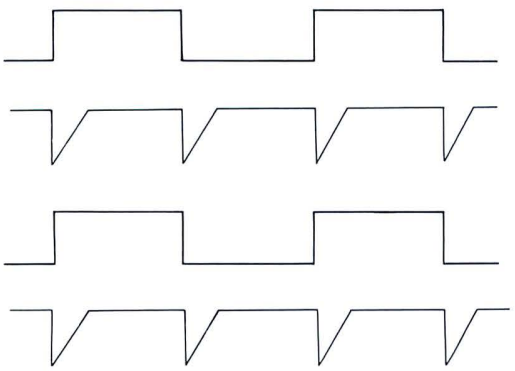
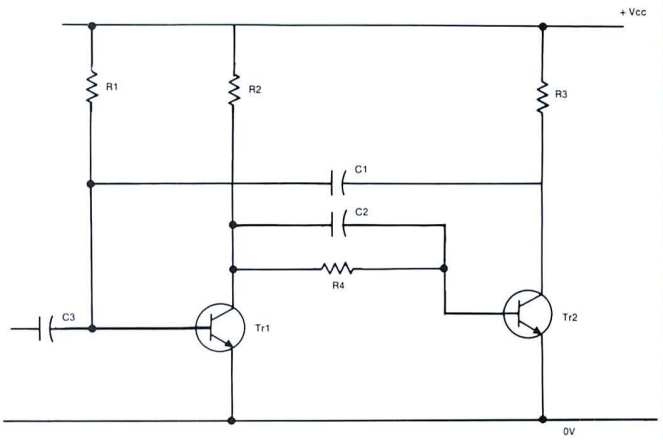


Figure 1. It is seen with the astable vibrator, as shown in the waveforms, that when Tr1 is turning off the collector voltage increases which in turn increases Tr2's base current. When Tr2 has reached saturation, then both Tr1 and Tr2 will turn off. The voltage on the base of Tr1 will then rise according to C1 and R1's time constant.



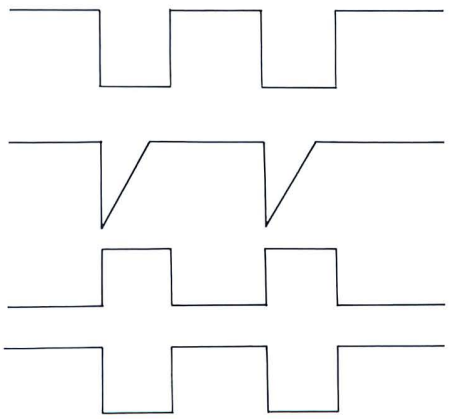
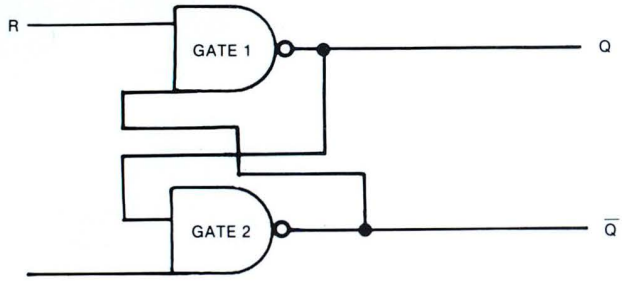


Figure 2. The input is coupled to Tr1 by C3. When the downgoing negative edge of the input reaches Tr1, then its collector voltage will rise which in turn will cause the base voltage of Tr2 to increase. After Tr2 has reached saturation it will turn off; therefore the collector voltage of Tr2 will drop, in turn turning off Tr1. It will be noted that C2 reduces Tr2 turnoff time.



R	S	Q	$\overline{Q}$
0	0	1	0
1	0	0	1
0	1	1	0
1	1	1	0

Figure 3. The truth table follow the rules for any logic circuit bistable multivibrator. In this case we are using the NAND gate configuration.

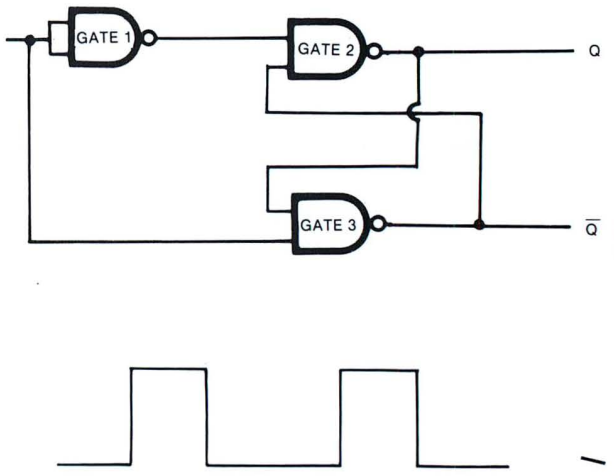


Figure 4. The inverter circuit is used as the follower when we want to change the input waveform into a different output wave.

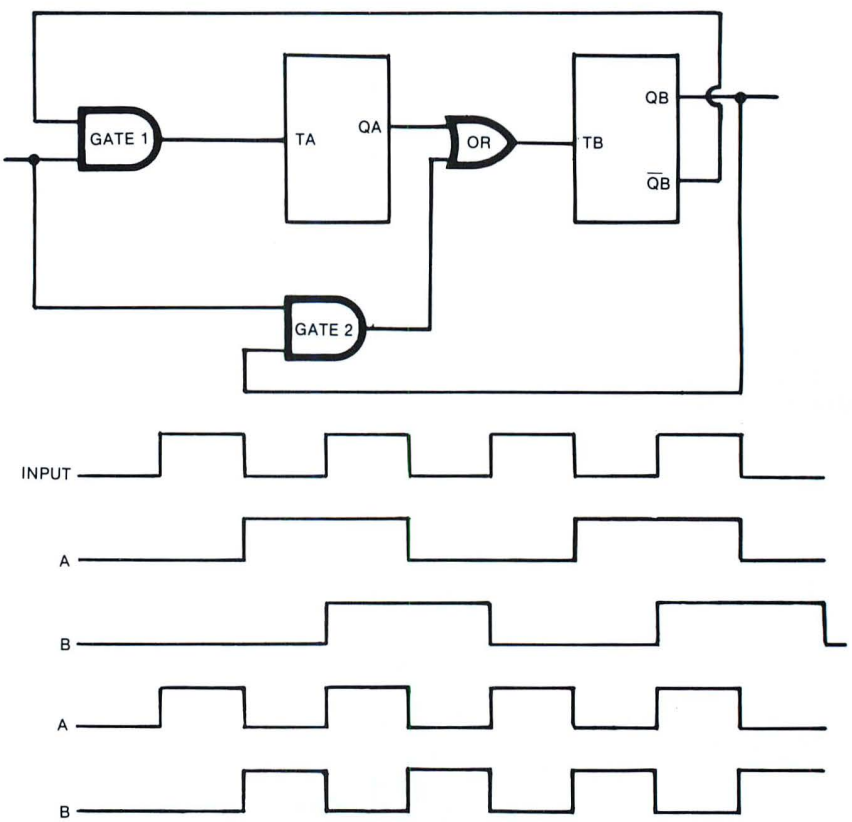


Figure 5. The OR gate is added to be able to count or divide by three by using an input and three outputs. Note that on QA and QB there is only one pulse with QB one clock cycle ahead of QA, and that on TA and TB there are two pulses with TB ahead of TA. This timing sequence enables the counter to set and reset.

or down-going change of the input which is the T terminal. This is shown in Figure 5. When an R-S-T is purchased, the user can apply it as an R-S-T flip-flop or if he wishes use it just as an R-S simply by not connecting the T into the circuit.

The R-S-T is particularly useful as a frequency counter. This can be accomplished by a down signal on T which causes the output at Q to change, hence alternating between different inputs at T brings about a change on Q's output. This type of action produces an output that has half the number of pulses in a given alloted time period. The output at Q is always a square wave provided that T's pulses are of the same time factor. This is shown in Figure 6.

The flip-flops when connected in series will divide by a power of two, four, eight, sixteen, etc., depending on how many there are in series. When using such an arrangement as a frequency counter, the answer will be based on the number of flip-flops used and will often be a number that is twice the number of flip-flops. For example, with two flip-flops in series the answer would be four, with eight flip-flops the quotient is sixteen, etc. When the count is completed it will automatically start the cycle over again.

The counter first begins counting by making sure that the Q outputs are all set to zero. For the rest of the discussion on the R-S-T flip-flop, we shall be working with the four-stage counter. After the counter has been set to zero, a certain number of pulses are applied to the input, this input is usually denoted by 2^n, the n denoting the number of flip-flops in series. The example in Figure 7 shows more clearly how a four-stage works.

It is often advantageous to use an AND gate when working with an R-S-T combination. This will enhance the dividing frequency of the counter itself. The idea is to allow the counter to divide to the "last count."[1] It will

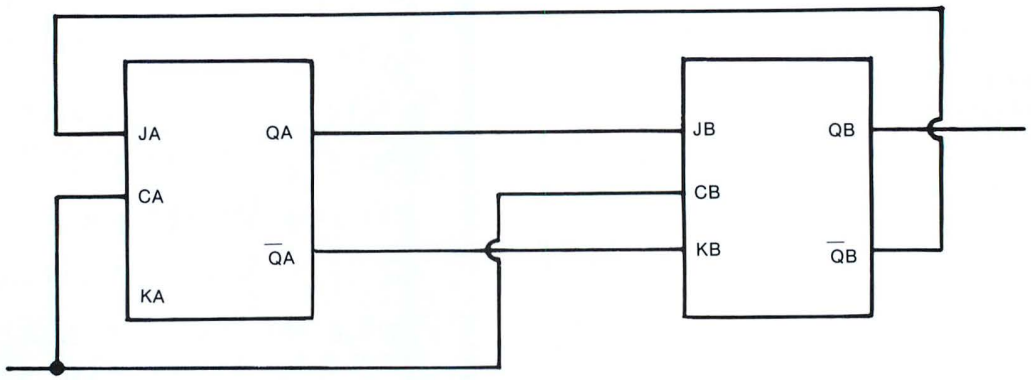


Figure 6. The J-K flip-flop follows almost the same principle in dividing as the R-S-T in that there is an input and two outputs.

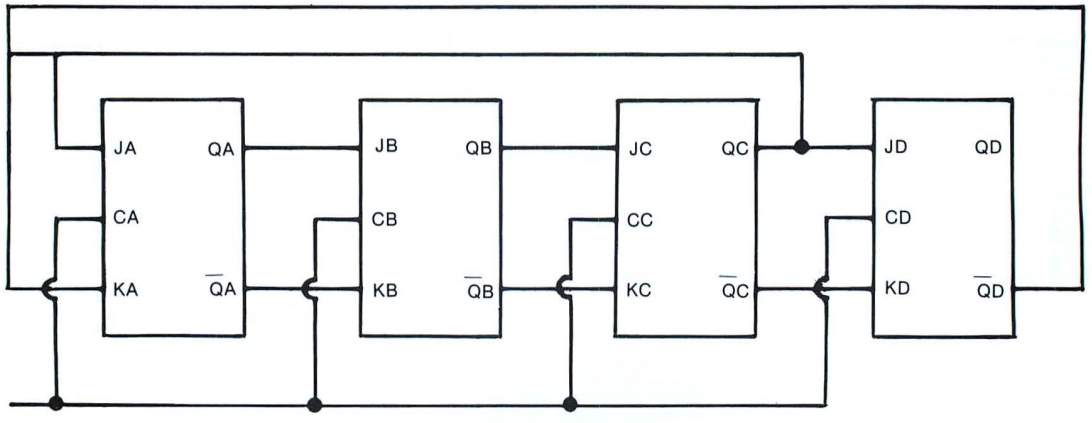


Figure 7. This counter divides by seven because there is one output from the final stage going back to the J input of the first stage, which resets the count, and also because of two inputs going to each succeeding stage.

also enhance the ability of the counter to handle the odd digits as well as the even ones. When using an AND gate, if the flip-flop is set to zero, then this will automatically start the counting sequence. This is done with one input of the AND input being connected to Q_B's output of the R-S-T which is set to 1 at the start. The first input that is high on the AND gates will not cause the R-S-T's to change state, but when it goes to zero, the flip-flop at (A) will toggle to one. The second flip-flop does not change its state because the input at T_B has not fallen. The input then goes back to high, which does not affect the change of either flip-flop, but when the input goes to zero, flip-flop (A) will change to a zero at the Q_A output and the second flip-flop will toggle, and the output at Q_B goes to one and Gate 1, which is tied to the output of Q_B, will become inhibited. At this point the second gate will be enabled. When the input rises and falls again it will go to the second AND gate, whose output is tied to the input of an OR gate that is connected to Q_A, its state still remaining at zero. Flip-flop B will also toggle to zero, and the count starts all over.

The R-S-T counter is a serial counter because each stage has to wait for the pulse from the preceding flip-flop.

The next flip-flop is the J-K device. This is a synchronous flip-flop because of the fact that the clock terminal which corresponds to the toggle of the R-S-T has its output synchronized to the J and K input signal. The R-S-T is asynchronous because the output is not in correlation with its input.

The operation of the J-K goes according to its truth table.

The terminals J and K are the inputs but do not necessarily affect Q's output. They do determine, however, what happens at Q on the downgoing or upgoing pulse at the clock terminal. This a synchronized output because it changed with the changes on the clock terminal.

The J and K terminals are either OR or AND gates. When using the OR gate, a 1 that is applied to one of the multiple inputs will cause it to trigger so as to have an output at Q. However, if an AND gate with multiple inputs is used all the J's or K's must have a 1.

Sometimes in logic design it will be necessary to tie the J and K inputs together and apply a trigger signal at that junction. This will also act as a clock terminal.

As I had said previously the J-K operates on the principle of the truth table. When Q_A and Q_B are both zero at the first count and a pulse arrives on the J-K terminals, then on the first flip-flop Q_A will toggle to a one and on the second flip-flop, Q_B will remain at zero. At the next input pulse Q_A will toggle again but this time Q_B will have a one on its terminal. When the third pulse arrives Q_A will still be zero and Q_B will be zero. This will start the count over again. These pulses are all "down-going pulses." If a square wave is used at the input, then the output waves at Q_A and Q_B will be the same rectangular waveform as on the "down-going pulse" except that there is no phase relationship between the high and low cycle.

The last flip-flop to be considered is the shift register. the flip-flops are connected together as stages or a staged flip-flop. Each flip-flop has an input and four outputs, in addition to a clock and reset terminal.

The often used application of a shift register is the conversion of "serial data" into "parallel data." This principle applies especially to calculators. For example, when multiplying 10 x 2, it will be fed into the logic circuitry one at a time by the user. The answer 20 is read by the LED's coming on all at the same time or in parallel.

REFERENCES

1. Streater, Jack W., *How to Use Integrated Circuit Logic Elements,* 1969.
2. Ward, Brice, *Solid-state Circuits Guidebook,* 1974.

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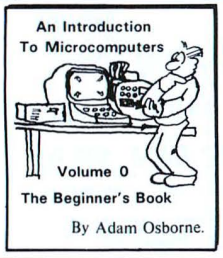

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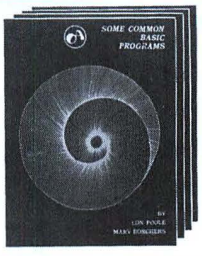

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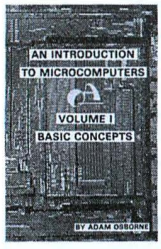

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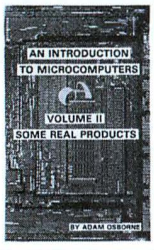

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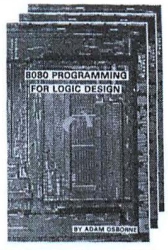

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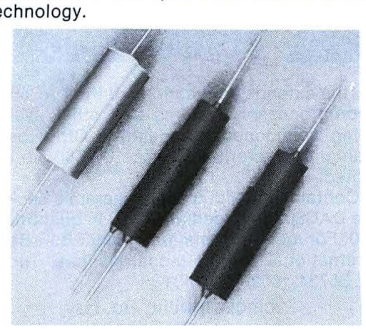


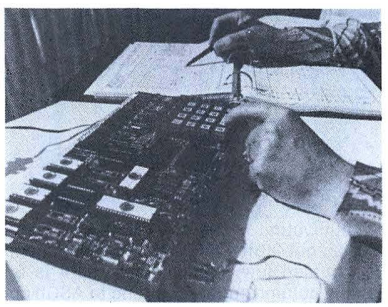
Units feature small size (.25" O.D. x .5" length) for fast response. Device is designed for more than three million operations at full rated load. Switches may be specified for N.O. (normally open), N.C. (normally closed), or a combination in a SPST (single pole, double throw) switch configuration. A metal package may be specified for high temperature applications. Switch temperatures are available from – 50°C and up.

For more information contact Midwest Components, Inc., P.O. Box 787, Muskegon, MI 49443, (616) 777-2602.

CIRCLE INQUIRY NO. 141

Self-Study Microcomputer Training System

Integrated Computer Systems, Inc. introduces the beginner-oriented, 8080A-based "Self-Study Microcomputer Software/Hardware Training Course." With built-in keyboard and display, no expensive teletype or CRT terminal is required.



Designed for use in the home or office, this course (No. 126) includes all system hardware, software and information best suited for learning to program and fully use an 8080-type microcomputer system. The 650-page workbook/text teaches 8080 instructions 1-by-1, programming, debugging and hardware interfacing through 33 hands-on exercises. System price: $545.00 (power supply optional).

For further information, contact Integrated Computer Systems, Inc., 4445 Overland Ave., Culver City, CA 90230, (213) 559-9265.

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Microprocessor Protection

Lightning and heavy-duty electrical equipment often creates power-line surges and transients. These can cause extensive damage to valuable microprocessors and peripherals.

Electronic Specialists is announcing a line-cord transient suppressor which will absorb repeated power surges, protecting delicate equipment.

Available in 2 prong plug/socket ($11.50) or 3 prong plug/socket ($14.50), these units are also available with integral power line hash filtering.

For more information contact, Electronic Specialists, Box 122, Natick, MA 01760.

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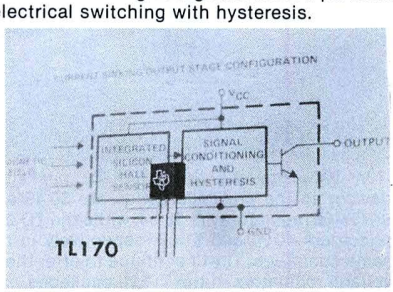
Hall Effect Electronic Switch

The TL170 is a bipolar magnetically-activated electronic switch that uses the Hall effect for sensing a magnetic field. It performs electrical switching with hysteresis.



This electronic switch is offered in a three-

pin TO-92 SILECT* plastic package. It is priced at 36¢ in 100-piece quantities. The device consists of a silicon Hall sensor, signal conditioning and hysteresis function and an output stage integrated onto a monolithic chip.

The output of the TL170 can be interfaced directly with TTL or MOS logic circuits. Applications include keyboard, limit, push button and proximity switches, as well as virtually any switch application.

For further information contact Texas Instruments Inc., P.O. Box 5012, M/S 308 (Attn: TL170), Dallas, TX 75222.

CIRCLE INQUIRY NO. 146

A78M00 & A79M00 Voltage Regulators

The TO-202 plastic power package offering substantial savings is now being used for the μA78M00 and μA79M00 series of voltage regulators from Texas Instruments.

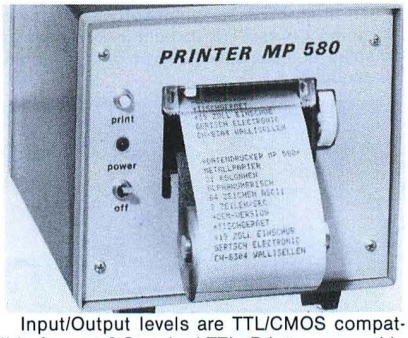
In 100-piece quantities, TO-202 packaged devices in the μA78M00 series are $0.49 and μA79M00 regulators are $0.54, while the TO-220 prices are $0.94 and $1.02 respectively in the same quantities. TI will continue to offer these voltage regulators in the TI-220 packages.

For further information, contact Texas Instruments, Incorporated, Inquiry Answering Service, P.O. Box 5012, M/S308 (Attn: A78M00KD, A79M00KD), Dallas, TX 75222, (214) 238-3527.

CIRCLE INQUIRY NO. 144

Alphanumeric Printer MP 580

The Printer MP 580 is a serial printer; printing is performed from left to right by a mobile head with 7 printing electrodes; the character is printed on the paper by a dot matrix generated by the control logic. The printing process is of the non-impact type on metallized, electrosensitive paper on which the printed characters are permanently recorded.



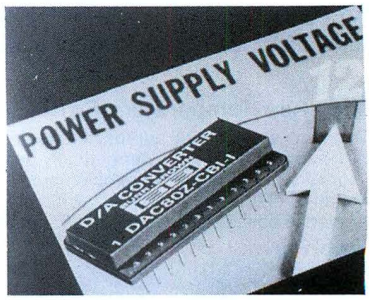
Input/Output levels are TTL/CMOS compatible fan out 2 Standard TTL. Print command is DC coupled low to high. Input data is 6 bit parallel column serial according to ASCII code. Address output is 6 bit binary coded positive logic (for parallel interface).

For further information contact Gertsch Brutsch AG, Hertistrasse 25, CH-8304 Wallisellen, Switzerland.

CIRCLE INQUIRY NO. 148

12-Bit D/A Operates from ± 12V Supplies

A recent addition to the popular DAC80 family now makes it possible for designers to use this industry standard D/A converter in systems having ± 12V supplies instead of the previously required ± 15V. The DAC80A is pin compatible with the DAC80 and meets all its specs with power supplies ranging from ± 11.4V to ± 16.0V.



This extends applications of the DAC80 into microprocessor systems and other systems using semiconductor memory. Other performance characteristics of the DAC80 are unaffected.

Contained in a dual-in-line ceramic package, the DAC80Z is priced at $19.50 in quantities of 100. For more information contact Burr-Brown, International Airport Industrial Park, Tucson, AZ 85734, (602) 294-1431.

CIRCLE INQUIRY NO. 135

Breadboard II

The Breadboard II has 3208 solderless plug-in tie-points on a universal .1" x .1" matrix. It will accept all DIP's and components with leads up to .032" diameter. No special patch cords are required, and it comes fully assembled.

This version of Breadboard II replaces the earlier version, and has a matrix that is comprised of 2,776 tie-points (512 terminals with 5 points each and 54 terminals with 4 points each) while the distribution matrix provides 432 tie-points (3 buses or 48 points on each of three strips).

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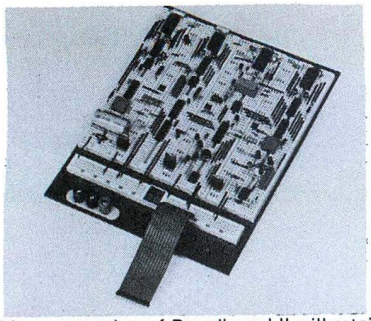
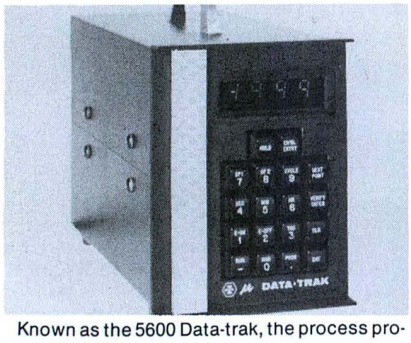


This new version of Breadboard II will retail for the same price as the original Breadboard II, $126. For further information contact A P Products, 72 Corwin Dr., Box 110, Painesville, Ohio 44077.

CIRCLE INQUIRY NO. 147

Data-Trak

The increasing use of microprocessor sophistication in equipment serving the growing process control industry is typified by a process programmer developed by Research, Inc., using the Signetics 2650 microprocessor.



Known as the 5600 Data-trak, the process programmer provides automatic programming of temperature, pressure, flow, speed and position plus on/off events during the program cycle.

The 5600 Data-Trak provides single or dual analog outputs versus time, plus seven on/off programmable events. The programs are generated by straight line segments that fit the users' desired profile.

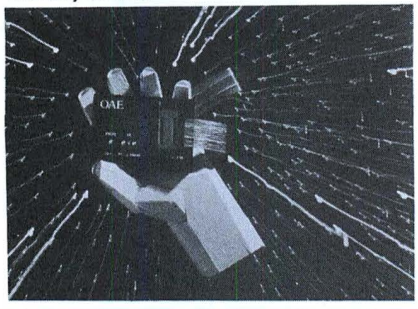
The microprocessor makes it possible to store and retrieve the program and to utilize a changeable program capacity, with up to 51 segments. Sense and flag bits are used to implement a low-cost TTY/Cassette interface for program storage. In addition, the company uses Signetics' compatible preprogrammed 2708 ultra-violet-erasable ROM circuits to allow for another 54 segments when a customer requires it.

For further information, contact Signetics, P.O. Box 9052, 811 E. Arques Ave., Sunnyvale, CA 94086, (408) 739-7700.

CIRCLE INQUIRY NO. 145

PP-2708/16 PROM Programmer

There is a new force in PROM programming! Oliver Audio Engineering offers a low cost series of piggyback PROM programmers. For example, the PP-2708/16 PROM Programmer plugs directly into any 2708 or TMS-2716 memory socket.



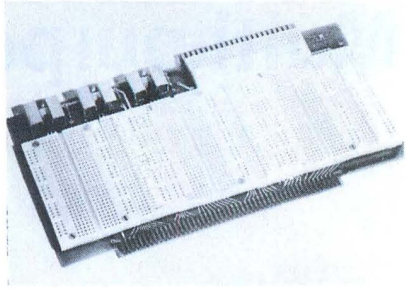
No additional power supplies are required and all timing and control sequences are handled by the programmer. Each unit comes with a DC to DC switching regulator, a zero insertion force socket and more.

Kit price is $249; fully assembled, tested and aligned price is $295. For further information contact Oliver Audio Engineering, 676 W. Wilson Ave., Glendale, CA 91203, (213) 240-0080.

CIRCLE INQUIRY NO. 131

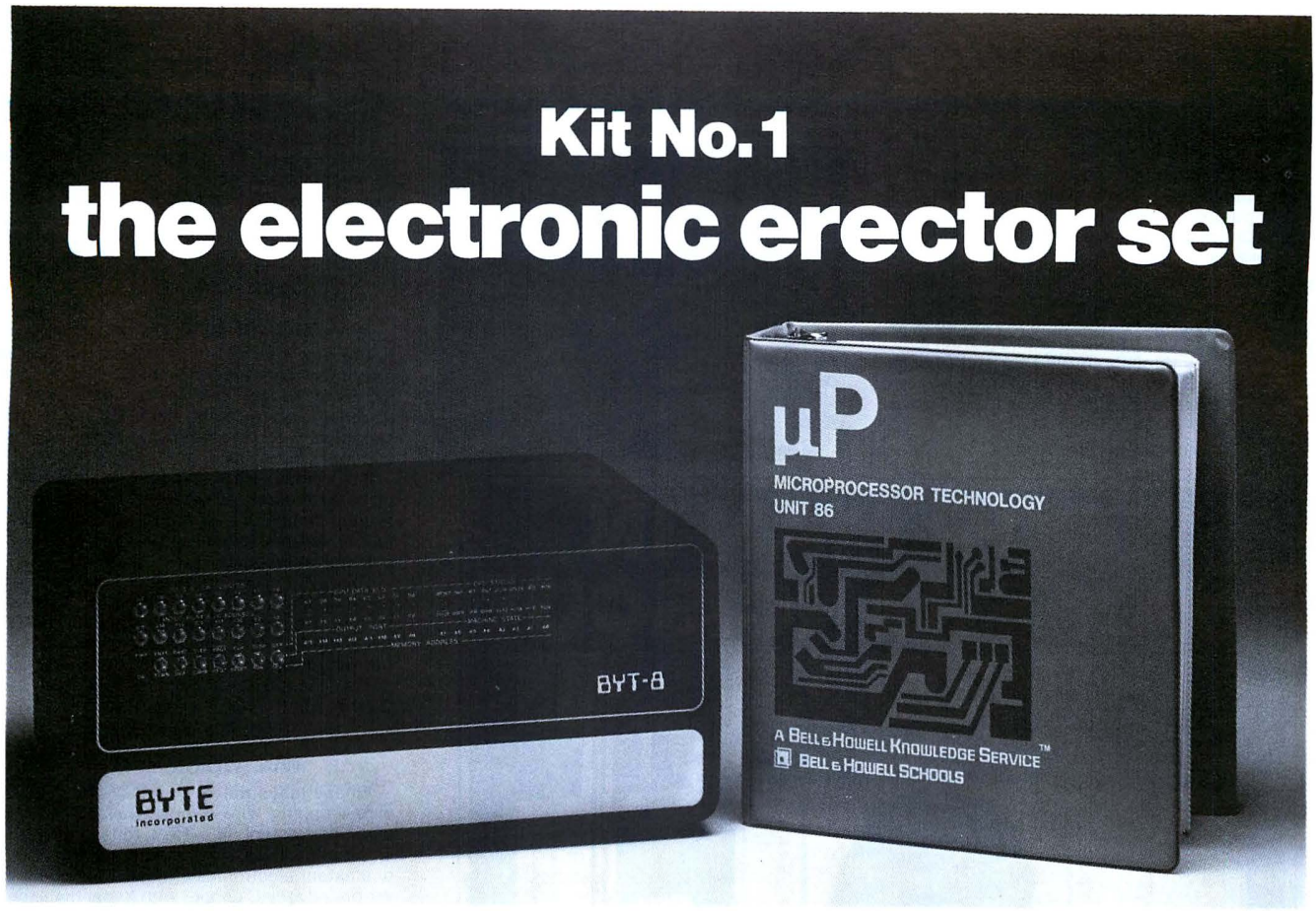
S-100 Microcomputer Breadboarding Cards

A universal breadboarding card for interfacing popular S-100 bus microcomputers with peripheral devices or experimental circuitry is now available from E&L Instruments, Inc. The S-100 plug-in card is a convenient, inexpensive means for organizing complete systems around Altair, Imsai, or other S-100 bus microcomputers.



Lines on the S-100 card are divided into address, data and control sections and the user has access to every signal generated by the microcomputer.

The price of the S-100 breadboarding card is $75.00 and are available from E&L Instruments,



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No more nuts and bolts. Today, it's bits and bytes. Or, bytes and bits, as the case may be. That is the bits and pieces of the microcomputer—the electronic erector set. The modern "toy" that stimulates while simulating and intrigues while interfacing.

Business, home or hobby room—there's a computer in your future. With the New Year just around the calendar, Christmas is a good time to start with this handsome gift of equipment; our powerful and popular 8080A microcomputer (pictured above). The funny numbers won't confuse you. The $499 also includes a 426 page instruction course that tells you what it all means. This course was prepared by Bell and Howell Schools and is the industry standard for basic computer instruction. To start all you need is a screwdriver.

To obtain this Christmas Special, or for more facts and figures on the Electronic Erector Set, visit the BYTE SHOP in your neighborhood. Pick up a *free* informational Computer Starter Kit. It tells a lot more about what we mean. Also included are a "get started" flow chart, the computer course syllabus, an official "byte me" button and, if you'll register your birthdate, we'll prepare your very own computer-made biorhythm chart (that's so you'll know the best day to start developing your computer, among other things). But hurry. Christmas isn't next February.

BYTE SHOP™
the affordable computer store

Stores now open in: **Arizona,** Phoenix, Phoenix-west, Tucson; **California,** Berkeley, Burbank, Fairfield, Fresno, Hayward, Lawndale, Long Beach, Marina Del Rey, Mountain View, Newport Beach, Palo Alto, Pasadena, Placentia, Sacramento, San Diego, San Fernando Valley, San Francisco, San Jose, San Mateo, San Rafael, Santa Barbara, Santa Clara, Stockton, Thousand Oaks, Ventura, Walnut Creek, Westminster; **Colorado,** Arapaho County, Boulder, Denver; **Florida,** Cocoa Beach, Ft. Lauderdale, Miami; **Georgia,** Atlanta; **Illinois,** La Grange; **Indiana,** Indianapolis-No.; **Kansas,** Mission; **Montana,** Billings; **Nevada,** Reno; **New York,** Levittown; **North Carolina,** Greensboro, Raleigh; **Ohio,** Columbus, Rocky River; **Oregon,** Beaverton, Portland; **Pennsylvania,** Bryn Mawr; **South Carolina,** Columbia; **Utah,** Salt Lake City; **Washington,** Bellevue; **Canada,** Vancouver, B.C.; Winnipeg, Man. Or write to Byte Incorporated, 1261 Birchwood Dr., Sunnyvale, California 94086. Or phone (408) 734-9000

Inc., 61 First St., Derby, CT 06418, or its representatives.

CIRCLE INQUIRY NO. 126

Pixe-Plexer Kit Model PXP-4500

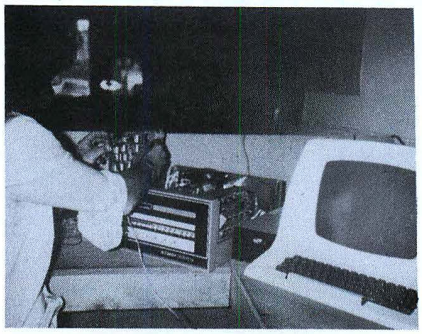
The Pixe-Plexer Model PXP-4500 is a special integrated circuit type modulator-RF oscillator module for multiplexing and interfacing color and luminance video signals plus audio from computers, TV cameras, VTR's, games, etc. for display on any regular TV set, via the antenna terminals.

Kit comes complete with assembly instruction plus engineering data sheet on IC for special applications designing. User price is $24.50 in single lots and is available from computer stores throughout the USA and Canada or direct from the factory. For information contact ATV Research, 13th & Broadway, Dakota City, NE 68731, (402) 987-3771.

CIRCLE INQUIRY NO. 128

Hardware Debugging Service

Are you in the process of designing a Turn Key Computer system? Do you have problems with interfacing the hardware? Are you looking for a company that can handle all your hardware problems which will allow you to concentrate on writing the programs and selling the system?



C.M.S. can assemble the systm and install it in your customer's office for you. Then if the customer would like a maintenance contract, C.M.S. is a highly qualified field service organization to handle almost all field service on major lines of microcomputer and data communications equipment. For more information contact Computer Machine Service, 2909 Oregon Court, Unit C-6, Torrance, CA 90503. (213) 328-9740 (Sales) or (213) 328-9760 (Service).

CIRCLE INQUIRY NO. 127

Lamp for Erasing PROMs

The new UVS-11E Short Wave Lamp is an erasing system featuring simple operation and foolproof safety features. The system is manufactured by Ultra-Violet Products, Inc. specifically for the small systems user and computer hobbyist.

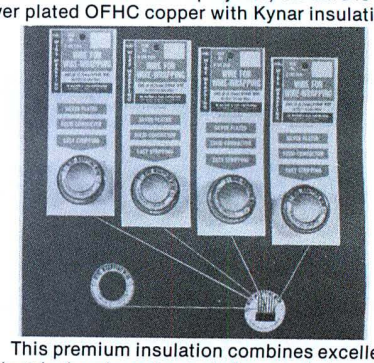
It will erase up to 4 chips at one time in as little as 20 minutes. An exclusive safety interlock system complies with the National Consumer Safety Act and protects the user against accidental UV exposure.

The system is lightweight, compact and comes complete with a holding tray for maintaining a constant exposure distance of 1". Available in 115 or 250V models at $59.50. For further information contact Ultra-Violet Products, Inc., 5100 Walnut Grove Ave., San Gabriel, CA 91778.

CIRCLE INQUIRY NO. 123

Wire-Wrapping Wire

Finest industrial quality AWG30 (0,25mm) wire-wrapping wire is now available on compact, convenient 50' (15m) rolls. Perfect for small production applications, prototype jobs or amateur electronics projects, the wire is silver plated OFHC copper with Kynar insulation.

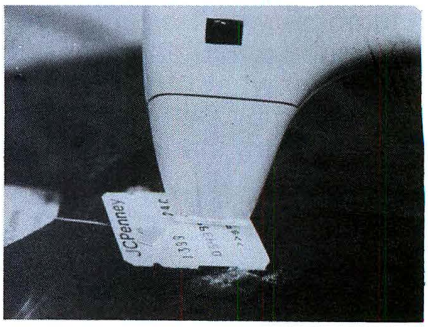


This premium insulation combines excellent electrical and mechanical characteristics with easy stripability and is available in 4 colors: red, white, blue and yellow. Packaged on 1⅝" (40mm) diameter spools for easy handling and storage. Available for immediate delivery. For further information contact OK Machine and Tool Corp., 3455 Conner St., Bronx, NY 10475.

CIRCLE INQUIRY NO. 114

OCR-A Scanner

A hand-held scanner which automatically reads prices and other information on merchandise tags in department stores has been released for sale by NCR Corporation.



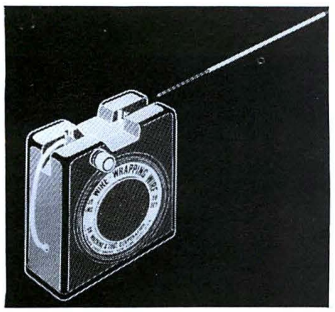
The NCR 7867, a pistol-shaped device weighign only 6 ounces, is moved by the salesperson over the merchandise tag. The information is printed in an Optical Character Recognition (OCR) type font which can be read by people as well as machines.

The scanner reads the data, edits it and transmits it to the NCR retail terminal to which it is attached. The scanner is an option available immediately with the NCR 280 and 250 systems. It will be released for the NCR 255 and 2151 systems in the future.

CIRCLE INQUIRY NO. 113

Wire Dispenser Also Cuts and Strips

New WD Series Wire Dispenser features unique cutting and stripping capability. Wire is drawn out of dispenser to required length. Then, built-in plunger cuts length free from roll, while a gentle pull through the stripping blade remove the insulation without nicking the wire.

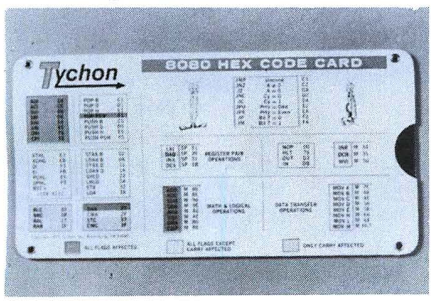


Repeat procedure removes insulation from second end. Although designed particularly for wire-wrapping, the inexpensive dispenser is ideal for many applications. Dispenser includes 50 ft. (15m) roll of AWG 30 (0,25mm) top industrial quality Kynar® insulated OFHC silver plated solid copper wire. Insulation is offered in blue, white, yellow or red. Available from your local electronics distributor or directly from OK Machine and Tool Corporation, 3455 Conner St., Bronx, NY 10475.

CIRCLE INQUIRY NO. 115

Tychon's 8080 Instruction Hex Code Slide Rule

Tychon's 8080 Instruction Hex Code Slide Rule is a sliderule-like aid for programming and debugging 8080 software. It contains all the mnemonics and their corresponding hexadecimal codes. The instructions are all color coded to indicate which flags are affected during execution. The pocket sized card measures 6.5 by 3 inches and it provides the instructions in a neat, logical format for quick reference.



The back side of the card is printed with an ASCII code chart for all 128 characters plus the 8080 status word and register pair codes.

Delivery of the 8080 Hex Code Card is immediate and the price is $2.95 postpaid. Quantity discounts start at ten units and custom printing is also available.

For further information write or call C.A. Titus at Tychon, Inc., P.O. Box 242, Blacksburg, VA 24060, (703) 951-9030.

CIRCLE INQUIRY NO. 112

P184 Slit-N-Wrap™

A second-generation product, the P184 Slit-n-Wrap™ bit makes gas-tight interconnections and uses 28-gauge silver-plated copper wire with five-mil (0.005 in.) thick Tefzel insulation fed from a spool on the tool's shaft.

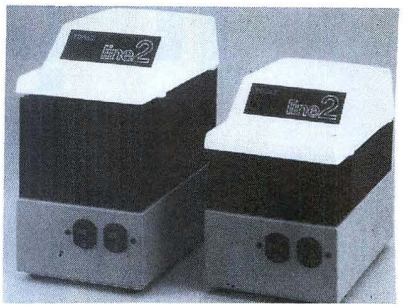
Available in 50-foot spools, the 28-gauge wire may be purchased with red, green, white or yellow insulation. For production wrapping, the bit is turned by Vector's Model P184T1 pistol-grip motor or Model P184T battery-powered pencil-type unit. A manual tool, Model P184 is also available. All tools are supplied with two spools of wire while the P184T includes battery and charger. The P184T1 is $89, the P184T is $80 and the P184 is $29.50. Delivery is from stock.

For further information contact Vector Electronic Company, 12460 Gladstone Ave., Sylmar, CA 91342, (213) 365-9661.

CIRCLE INQUIRY NO. 129

Topaz Line 2

The Topaz line 2 power line conditioner protects sensitive electronic equipment against electrical interference which can cause data processing errors, computer memory loss or program wipe out.



When you buy a microcomputer, is this your technical support?

A stack of do-it-yourself books?

At The Computer Mart, we back what we sell with technical support. From assembling kits for personal use to building microprocessor systems for business. Like word processing, simulation, control or data acquisition.

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At The Computer Mart, we do more than just sell computers.

For professional advice before choosing your system, call The Computer Doctor.

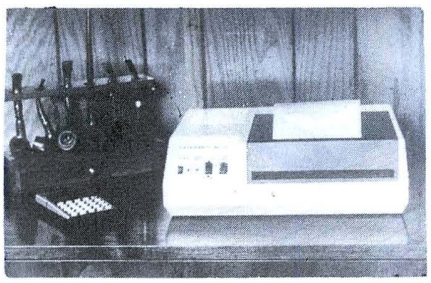
The Topaz line 2 filters and regulates electrical power to assure clean, noise-free, regulated power. The lightweight, portable unit does not require installation; it is simply plugged into any existing 120 volt outlet. Two standard 3-prong receptacles are provided for powering equipment in need of protection.

Two models, rated at 1 kVA and 2 kVA, are available from stock. For information or brocure, contact Topaz Electronics, 3855 Ruffin Road, San Diego, CA 92123.

CIRCLE INQUIRY NO. 130

$595 Nonimpact Microprinter

The Micro 1 is a nonimpact, high speed, low cost, compact microprinter utilizing electric discharge technology and special aluminum coated paper.



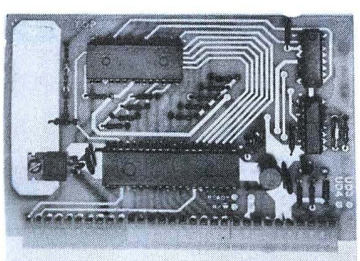
The Centronics microprinter has a print speed of 240 characters per second and sells for $595. It is offered as a complete unit including case, power supply, 96 character ASCII generator and interface, paper roll holder, infrared low paper detector, bell, and multi-line asynchronous input buffer.

For further information contact Centronics Data Computer Corp., Hudson, NH 03051, (603) 883-0111.

CIRCLE INQUIRY NO. 132

SWTPC MP-N Calculator Interface

Southwest Technical Products Corporation has just announced a calculator interface that is plug compatible with their SWTPC 6800 Computer System. The interface uses the new National Semiconductor MM57109 Number Oriented Processor and features Reverse Polish Notation, floating point or scientific operation, up to an eight digit mantissa and two digit exponent, four register stack, memory register, trig functions, base ten and natural logarithms and overflow indicator.



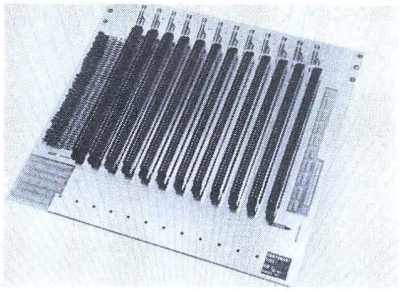
The interface plugs onto of the the seven interface card positions and is powered by the computer systems's power supply. The unit is sold in kit form only and includes the 3½" x 5¼" circuit board, all components, assembly and operating instructions for $46.50 ppd. in the U.S.

For further information contact Southwest Technical Products Corporation, 219 W. Rhapsody, San Antonio, TX 78216, (512) 344-0241.

CIRCLE INQUIRY NO. 121

QM-1

The QM-1 is a twelve slot S-100 mother board. The Kluge area will accept up to two 12-pin sockets, four 14-pin sockets plus connections to all pins.

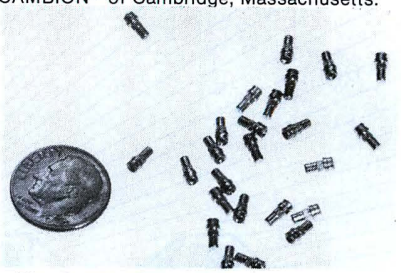


Documentation includes photos of front and back of board without parts so that all traces can be seen. Prices are $35 bare (without parts); $85 kit; $100 assembled and tested. For further information contact WMC, Inc., 3107 Laneview Drive, San Jose, CA 95132.

CIRCLE INQUIRY NO. 122

Self-Retaining Knurled Cage Jack

A self-retaining knurled cage jack that takes up to 50,000 insertions and withdrawals without lifting or rotating has been introduced by CAMBION® of Cambridge, Massachusetts.



The Cambion® is a self-retaining miniature connector that enables you to make reliable connections for thousands of insertions and extractions. Designed for absolute alignment

and retention, it will not lift or rotate before or during soldering in a .063" thick printed circuit board. It accommodates a .040" (1.02mm) plug or pin.

Cambion® P/N 450-3954-01-(03,04,06)-00 Knurled Cage Jacks sell for $120.00 per thousand in gold; $93.50 per thousand in tin and $105.00 per thousand in gold and tin. For more information contact CAMBION® Cambridge Thermionic Corp., 445 Concord Ave., Cambridge, MA 02138, (617) 491-5400.

CIRCLE INQUIRY NO. 117

ACCU-FILE 1401

The ACCU-FILe 1401 was created to make your mag card life a little easier. Search and retrieval are instant, because the small files are centralized into one convenient, easy to use case. Designed with low sides, the 1401 provides quick access to mag cards. They are stored horizontally with clear visibility of the card jackets, and can be read like file cards without removing or repositioning them in the file case. When looking for a specific card, just fan through the file.

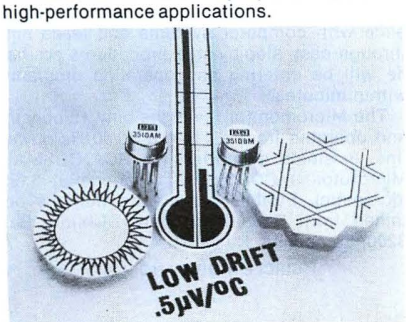
Made of super space age polymer, the same material used in NFL football helmets, the ACCU-FILE 1401 will fit a standard desk drawer or can be stacked two or more high on a shelf. The lid is removable for use as a tray, but fits securely when attached holding the contents of the case firmly in place — even when carried. No danger of cards spilling into another storage section, they remain in place where they were filed. The lid also protects the cards from dirt, dust and environmental contamination that harm your machine and prevent the retrieval of information. The case features a key lock for file integrity.

The ACCU-FILE 1401 holds 125 mag cards with jackets and 750 without. For further information contact Advance Access Group, Inc., 15026 W. Cermak, Westchester, IL 60153, (312) 562-5210.

CIRCLE INQUIRY NO. 111

Instrument Grade IC Op Amp with Low Drift

The 3510 Precision Operational Amplifier offers designers very low drift plus an excellent combination of other key specifications for high-performance applications.



Production trimming assures a low input offset voltage drift of less than ± 0.5 μV/°C. Trimming also provides initial input offset (25°C) of less than ± 60 μV, often eliminating the need for external trimming circuits.

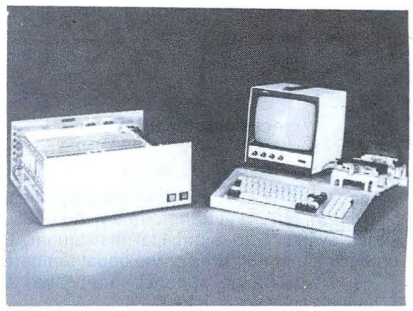
Packaged in a TO-99 case, the 3510 is available in three grades. The BM version provides the above mentioned specifications over the temperature range of − 25 to + 85°C. The AM version delivers ± 1 μV/°C drift (max.) and ± 120 μV offset (max.) over the range of − 25 to + 85°C. The RM version has the same spec's as the AM over the range of − 55 to + 125°C.

The 3510AM is $9.00 (1-24), $7.35 (25-99) and $5.95 (100-999). Prices for the 3510RM and BM are $14.75, $11.50 and $10.00 respectively. Delivery is from stock. For more information contact Burr-Brown, International Airport Industrial Park, Tucson, AZ 85734, (602) 294-1431.

CIRCLE INQUIRY NO. 110

The Basic Box and The Peripheral Plate

The Digital Group, Inc. has announced two new products—the Basic Box and the Peripheral Plate—intended for the basic computer experimenter who is trying to get the absolute maximum results with a minimum dollar expense.



The Basic Box is intended to provide all the mechanical requirements for a Digital Group system's mainframe. The complete Basic Box kit with all hardware features sells for $95.

The Peripheral Plate is designed to help organize Digital Group input-output devices. It is simply a piece of semi-finished heavy duty aluminum bent to be self-supporting, and

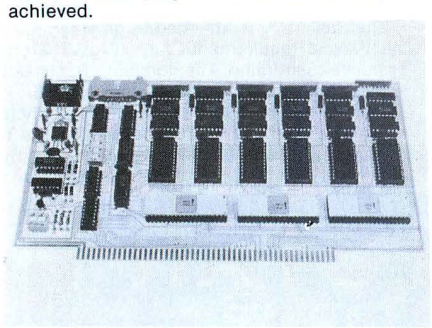
prepunched for a keyboard and two Phi-Desk cable routing holes. The Peripheral Plate in kit form is priced at $19.50.

For details, contact The Digital Group, Inc., P.O. Box 6528, Denver, CO 80206, (303) 777-7133.

CIRCLE INQUIRY NO. 125

Altair 88-MU1

The Altair 88-MU1 musical note synthesis board from MITS will transform any Altair 8800 series system into a musical instrument. By producing eight octaves of the equal tempered scale, a wide range of tonal variety may be achieved.



Up to six channels of sound may be produced simultaneously, allowing polyphonic music (two or more voices) to be played. Within each channel, eight octaves of a single note can be sounded concurrently. This means that a maximum of 48 notes may be sounded at once. Square wave outputs from the board can be amplified to drive speakers and headphones.

Software consists of a high-level, musical composition language which is included with purchase. For further information contact MITS, Inc., 2450 Alamo S.E., Albuquerque, NM 87106.

CIRCLE INQUIRY NO. 124

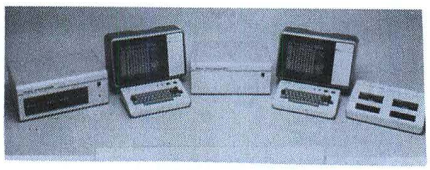
DIP/IC Insertion Tool with Pin Straightener

New Model INS-1416 DIP Insertion Tool inserts both 14 and 16 pin IC packages into sockets or predrilled boards. Durable glass-filled Lexan construction features precision parts for long life and easy one-hand operation. Narrow profile permits tool to work on densely spaced patterns, while unique insertion mechanism assures accuracy as well as excellent "feel." Finally, the tool includes a remarkable pin straightener built into the handle. Simply insert the IC, rock it on the straightening saddle, and push down on the tool. An automatic ejector delivers the IC ready to be placed in the insertion end for installation in your board or socket. Economically priced at $3.49 the INS-1416 is available at your local electronics distributor or directly from OK Machine & Tool Corp., 3455 Conner Street, Bronx, NY 10475.

CIRCLE INQUIRY NO. 116

Universal Dual Microcomputer Development Systems

MICROSYSTEM 10/10, consisting of two complete, ready-to-use, tape-based 8K systems, including two high speed CRTs, two keyboards, two dual tape units, operating software and manuals, is priced at $5850.



MICROSYSTEM 30/30 provides two complete standard 8" floppy disc based systems each with 16K bytes of RAM. Other configurations combine 32K QUICKRUN™ tape-based co-resident systems with standard or mini floppy 16K systems.

For each half of the system, the user may specify an 8080, 6800 or Z-80 microprocessor and choose from a variety of hardware/software operating systems to best suit his application. Availability is 30 days ARO. For more information contact Futuredata Computer Corp., 11205 So. La Cienega Blvd., Los Angeles, CA 90045, (213) 641-7700.

CIRCLE INQUIRY NO. 133

Floppy-Disc Interface Card

Data Systems Design, Inc., announces a card for interfacing the firm's DSD 210 floppy-disc system to DEC's LSI-11 minicomputer.

The increased capabilities of the new interface card—designated DSD 210-L11A—include a hardware bootstrap, dynamic-memory refresh logic, and bus termination circuitry. Because it combined the principal features of DEC's REV-11 card with those of an existing Data Systems interface card (DSD 210-L11), the DSD 210-L11A eliminates the need for the DEC card and saves one Q-bus slot in the LSI-11.

All floppy-disc systems from Data Systems include an appropriate interface card. For users who may wish to purchase a card alone, however, the firm makes the DSD 210-L11A available at a cost of $319 each; an OEM discount schedule applies to quantity purchases. Delivery is 30 days ARO.

For more information on the DSD 210-L11A, contact Data Systems Design, Inc., 3130 Coronado Dr., Santa Clara, CA 95051, (408) 249-9353.

CIRCLE INQUIRY NO. 134

COSMAC Microtutor II

Intended especially for engineers, students, and hobbyists who wish to understand and use microprocessors, RCA Solid State's COSMAC Microtutor II, CDP18S012, is a complete basic microcomputer system available for quick and easy hands-on operating and programming experience.

The new RCA COSMAC Microtutor II, preassembled and containing its own regulated power supply, is based on the RCA CDP1802 CMOS 8-bit microprocessor and supersedes the original Microtutor CDP18S011. The CDP18S012 provides input via eight binary toggle switches and output on two seven-segment LED hexadecimal digit displays plus a Q LED output. Additional toggle switches are provided for all the required controls to examine and alter memory locations and to initiate program execution.

Accompanying Microtutor II is a 64-page manual, MPM-209, written in a light style with the beginner in mind. The manual provides numerous application examples and stresses that computers can be entertaining. The manual assumes that the user has minimal experience with computer systems and leads him through easy step-by-step procedures so that he will be entering and operating programs within minutes.

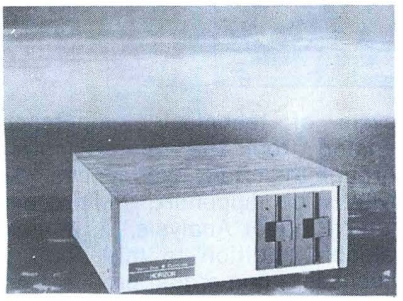
The Micromonitor II weighs only 18 ounces and operates from a 115-volt 50/60 Hz power line. In single quantities, the RCA COSMAC Microtutor II CDP18S012 is priced at $195 (domestic). Further information may be obtained from RCA Solid State Division, Box 3200, Somerville, NJ 08876.

CIRCLE INQUIRY NO. 136

Horizon

A complete, high-performance microprocessor system with integrated floppy disc memory is available from North Star Computers, Inc. Called HORIZON™, the system is designed for business, educational and personal applications. Horizon is ready for programming in

extended disc BASIC with the addition of a CRT or hard-copy terminal.



The Horizon system is available in two models. Horizon-1 includes a Z80A processor, 16K RAM, minifloppy disc and 12-slot S-100 motherboard with serial terminal interface—all standard equipment. The Horizon-2 includes a second built-in disc drive.

Horizon 1: $1599 kit; $1899 assembled. Horizon 2: $1999 kit; $2349 assembled. Delivery is 30 days on receipt of order. For more details write North Star Computers, Inc., 2465 Fourth St., Berkeley, CA 94710, (415) 549-0858.

CIRCLE INQUIRY NO. 137

GHOST

The GHOST is the Gimix House Operating System Technology. It makes your system do what you tell it, or it does what you want without being told. The Ghost has a long memory: Commands may be entered up to one year before execution.

Two or more users can operate 2 or more keyboards over 2 or more video channels at the same time. Anyone who can operate a push-button phone can operate this system. Video based and designed so that every TV is a readout as well. 16-button, 2-wire keyboards can be easily wired anywhere and everywhere. You can operate Ghost from practically anywhere, not just at the computer.

The flexible system can be used by a novice, or the most sophisticated hobbyist. Customize your needs through component boards. Can be readily expanded as your needs grow.

All boards assembled and tested 100%. Solder masked, using only top quality components designed for lowest power consumption and coolest operation.

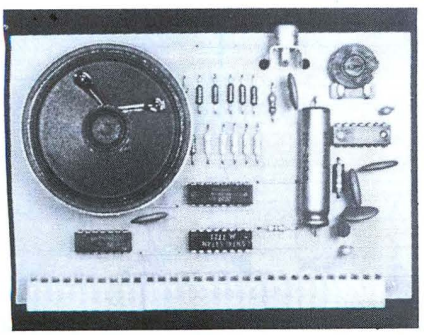
For more information on GHOST, contact Gimix, Inc., 1337 W. 37th Pl., Chicago, IL 60609, (312) 927-5510.

CIRCLE INQUIRY NO. 138

Music for SWTPC Owners

The Newtech Model 68 Music Board enables the user to generate music, sound effects, rhythms, Morse code, and touch-tone synthesis.

The Model 68 Music Board, designed for the Southwest Technical Products Corp. 6800 computer, comes fully assembled and tested. It consists of a digital-to-analog converter, audio amplifier, speaker, volume control and phono jack for convenient connection to an external speaker or home audio system.



A complete Users Manual is supplied with the Model 68. It includes sound effect programs, test routines, and listings of a BASIC program for writing musical scores and a 6800 Assembly Language routine for playing them. An AC-30 compatible cassette, supplied with the Model 68, contains programs from the Users Manual and software for pre-coded songs.

The Model 68 Music Board is $59.95 through computer stores. For further information contact: Newtech Computer Systems, Inc., 131 Joralemon St., Brooklyn, NY 11202.

CIRCLE INQUIRY NO. 120

Debugging Program for the 8080

DBUG: An 8080 Interpretive Debugger, a program for entering, debugging and storing assembly language programs by Christopher and Jonathan Titus, is available in a book from E&L Instruments, Inc. The 100-page paperback is the first of a BUGBOOK Application Series on assembly language programming. DBUG permits the user to enter a program into an 8080 microcomputer memory and single-step it through, instruction by instruction.

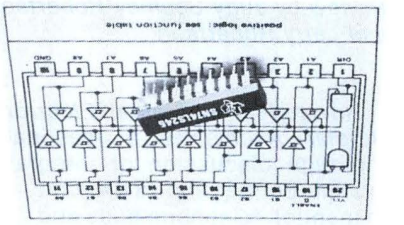
DBUG will reside in a 1K byte block of memory and a bootstrap loader for loading the DBUG into memory is included. Two complete listings of DBUG are given in the appendices—one in octal code and the other in hexadecimal code, each with appropriate I/O subroutines.

DBUG: An 8080 Interpretive Debugger sells for $5.00 and is available from E&L Instruments, Inc., 61 First St., Derby, CT 06418, (203) 735-8774, and its representatives.

CIRCLE INQUIRY NO. 139

Low Power Schottky TTL Octal Bus Transceiver

Designated the SN54LS/74LS245, the IC which comes in a high density 20-pin dual-in-line package, is designed for asynchronous two-way communication between data buses. The control function implementation minimizes external timing requirements.



The SN54LS version offered in a ceramic dual-in-line package (J suffix) is characterized for operation over the full -55° to 125°C military temperature range; the SN74LS in both ceramic and plastic (N suffix) DIP operates over the 0° to 70°C range. The SN54LS/74LS245 is available from TI authorized distributors or from TI Dallas. Prices in 100-piece quantities are: SN54LS245J, $3.00; SN74LS245J, $2.02; SN74LS245N, $1.40.

For more information contact Texas Instruments, Inc., IAS, P.O. Box 5012, M/S 308 (Attn: SN54LS/74LS245), Dallas, TX 75222.

CIRCLE INQUIRY NO. 140

BOOK REVIEWS

HOW TO PLAN AND INSTALL ELECTRONIC BURGLAR ALARMS

By Howard Bierman.
Hayden Book Co., Inc., 1977.
120 pages, $4.95, paper

Review by Judy Scolney Robertson and Larry Robertson

How to Plan and Install Electronic Burglar Alarms is a reasonably thorough discussion of integrated system burglar and fire alarms, not to mention telephone bugs and their avoidance. This book is of particular interest to the computer hobbyist, as in grouping the various systems into types and describing the operation of each, it provides a good information basis for hooking up a complete security system to the home computer. And let's face it — if you have a computer at home, you really do need a security system.

Alarms discusses using everything from independent wiring to radio transmissions to house wiring. It explains multiple types of detectors, including photo-electric, audio (ultra sonic), radar, body heat, body weight, odor, magnetic and television monitoring. The book also tells quite a bit about installing each type, and lists several manufacturers with equipment which is already set up.

Although not the ultimate book on surveillance and protection systems, *How to Plan and Install Electronic Burglar Alarms* gives a fairly good view of what is involved in installing and planning an alarm system for the person with some knowledge of wiring.

STIMULATING SIMULATIONS

By C. William Engel.
C. William Engel, 1977.
64 pages, $5.00, Paper

Review by Judy Scolney Robertson and Larry Robertson

Stimulating Simulations is a collection of ten extremely well-documented computer games for the very small computer. The games are not complicated, and the user will soon wish to make them more difficult. Engel has anticipated this eventuality by including some of the data necessary to modify his programs.

The games in *Simulations,* Art Auction, Monster Chase, Lost Treasure, Gone Fishing, Space Flight, Forest Fire, Nautical Navigation, Business Management, Rare Birds, and Diamond Thief, are by no means unique, but the BASIC code is well documented and easily followed. Engel has provided flow charts for each game, and has also included a narrative scenario along with each program.

Each game's section includes a sample run, but these examples appear to have errors which would not appear if they were true output of computer runs. These errors do not seriously detract from the descriptions of the games, however.

Stimulating Simulations is a nice addition to the computer game addict's library, but we feel that the $5.00 price tag is a bit high, like by a factor of two or three. However, if you do wish to order this self-published booklet, send your $5.00 to C. William Engel, Box 16612, Tampa, Florida 33687.

MICROCOMPUTER HANDBOOK

By Charles J. Sippl.
Petrocelli/Charter, 1977.
480 pages, $19.95.

Review by Judy Scolney Robertson and Larry Robertson

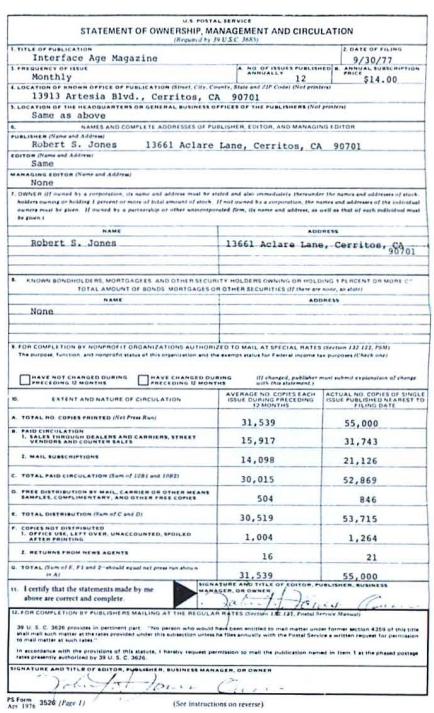
The *Microcomputer Handbook* is a guide to small computers for the novice user. Aimed primarily at the small businessman who is just about to embark on a journey into the wonderful world of microcomputers, this book covers a wide range of subjects related to the purchase, selection and use of low-cost micro-miniaturized devices.

Sippl more than adequately compares minicomputers and the large scale computers with which we have been familiar for so long with the new cheaper micros that are now available. He also discusses many and varied applications of computers in the home and in business uses, including supermarket cash registers, electronic funds transfer, communications, production control, and numerical control.

The *Handbook* goes into sufficient detail that it can be read on several levels of technical competence, ranging from the relative novice through the totally experienced hobbyist. The appendix, "Microcomputer Product Analysis," is a most valuable addition to this book. It discusses numerous products by name, giving a short review of the specifications of each and often comparing them with each other. Another appendix, "Analysis of Design and Testing Tools: Software Support Systems," is equally valuable in its discussion of assemblers, editors, loaders, simulators, and debuggers in detail.

The *Handbook* includes diagrams of storage formats, configuration block diagrams, diagrams of system operations and sample flow charts. In addition, Sippl provides a glossary at the end of each chapter, a particular handy aid for the relative novice. Sippl advocates an approach to data processing which includes standardized documentation and efficient, easily maintained code. His advice is extremely helpful in building a new data processing installation.

Microcomputer Handbook should be on the bookshelf of anyone considering installing a data processing operation in his home or business. It is a thorough and readable account of numerous factors involved in the creation and operation of a computer system written for the relative layman, but of significant interest to the hobbyist as well.



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SOFTWARE SECTION

By Abe Perez

Compared to this section of the magazine in previous months, this issue contains relatively fewer programs—four. One reason for the brevity of this section this month is a decision to postpone the publication of some software articles which are better suited to be published in a single issue of the magazine rather than in multiple installments.

This seems to be the more practical approach to provide the reader a better insight into the structure of the relatively complex programs promised for future issues. Many readers are anxious to see data-base management software for a home or hobby computer. This is the class of software intended for future issues of this magazine.

The four software articles in this issue include two games, a practical application of a random number generator, and finally, a utility program to facilitate preparation of paper tape programs for use with the Intel SDK-80 monitor kit.

In response to over 300 calls from our readers about the errata in William Mitchell's BIORHYTHM program, (INTERFACE AGE, October issue) we are publishing a new listing revised by the author. We hope it works. We were astonished to find out how much interest this subject has generated. In the course of 1978 we shall be publishing Biorhythm programs for other equipment. Watch for them.

The INJUN POKER game by 12-year-old Kenneth Kolbly is a fun game for families with small children and seems not too difficult to modify to allow more than two players to play at one time. The program was written for the IMSAI 8080 using Rev. 4.0 12K Extended BASIC.

The PIRANHA GAME program by Jeb and Elizabeth Long requires about 2400 bytes of memory. According to the authors, the program can "easily be modified to operate on almost any memory-mapped video monitor device."

The RANDOM NUMBER PROGRAM FOR SECURITY COMBINATIONS is a practical application of random numbers other than in simulation, where pseudo-random numbers are preferred. It is not clear how the lock combination numbers are managed in the particular application but this editor wonders how many copies of the list of lock numbers are *maintained* and what happens if the last maintained list is lost! These are merely random thoughts by this editor but I feel assured that these problems had been eliminated by good management at the particular facility where this program is used.

The PUNCH & READ INTEL FORMATTED TAPE software seems self-explanatory to those familiar with the Intel Evaluation Kit SDK-80.

Word of Caution: None of the four software articles described in this issue were actually run at this publisher's facility, let alone any semblance of a validation and verification attempt on any of them. As in the case of textual material published under an author's byline, INTERFACE AGE assumes no responsibility for the content. Equal space shall be allotted for replies to controversial views and corrections to published programs shall be printed in following issues. All letters addressed to authors in care of this magazine are forwarded to the authors for personal reply.

LOOKING BACK . . .

In 1977 INTERFACE AGE, Volume II has featured some outstanding software articles. Topping the list, of course, are Bud Shamburger's two contributions PAYROLL PACKAGE and GENERAL LEDGER PACKAGE. A straw vote of the editors selected the following for this list.

JANUARY ISSUE
Consol 1K Resident Operating System
by Processor Technology

FEBRUARY ISSUE
Microcomputer Stock Options
by Ed Christianson

BASIC Algorithms for Common Math Functions
by Michael Burton

MARCH ISSUE
Menace of the Micro World
by Ken Berkun

Graphics — The Easy Way
by Marvin Mallon

APRIL ISSUE
Proposed Cassette Data Storage Format Standard
by Lorin S. Mohler

MAY ISSUE
Robert Uiterwyk's 4K BASIC Interpreter Program
By William W. Turner

User TTY Handler for the Z-80 Development System
by Richard E. Maly

John Conway's Game of Life
by Alan R. Miller

JUNE ISSUE
General Payroll Package
by Bud Shamburger

Star Lanes
by Steven Faber

JULY ISSUE
Diablo Output Driver Routine
by Chris Terry

AUGUST ISSUE
Viking Uplink/Downlink
by Sven Grenander

Local Sidereal Time and Date
by James J. Brennan

Fortran/Basic Conversions
by William C. Thompson III

SEPTEMBER ISSUE
General Ledger Package — The Micro Bookmaker
by Bud Shamburger

Depreciation Schedule Analysis Program — JHDSAP
by Jim Huffman

OCTOBER ISSUE
Program to Calculate Winds Aloft Using A HP25 Hand Calculator
by Brian Finke

Assembly Language Structured Programming — Stars
by Ed Keith

NOVEMBER ISSUE
Molyprocessor Music
by Darrel J. Van Buer

Blockade
by Kenneth Berkun

SOFTWARE BUG

In our October issue we left out an entire column of Gregory A.R. Trollope's article entitled M6800 FORTRAN Cross Assembler Program. This erratum picks up the text on the third column of page 151 and continues it to Line 250 of the listing. We are sincerely sorry that this occurred.

Then the CLIST below can be used to invoke the assembler with the command:

EX (ASSEM) 'EXAMPLE'

```
CLIST(ASSEM)
00010 PROC 1 DA
00020 ALLOC DA(&DA..DATA) F(FT01F001)
00030 ALLOC DA(&DA..0BJ.DATA) F(FT02F001)
00040 ALLOC DA(SYS.DATA) F(FT03F001)
00050 LOAD ASSEM
00060 FREEALL
READY
```

This command operates from the COMMAND or EDIT modes of TSO.

The file SYS.DATA should be initialized to 0000 (4 zeroes) at the beginning of the first line.

EXAMPLE

As an example of the output produced by the Assembler, a listing is given of a routine to transfer the contents of memory to a TSO dataset in Motorola paper tape format, using the MIKBUG® routines. This output may be reloaded with the MIKBUG® load command (as may the Assembler object code, of course).

A point worth mentioning is that TSO requires an even parity XOFF after receiving a full speed character string — the BI-SYNC adapter apparently requires it to control the communications line properly. Also, TSO sends an XON at the end of its output, to inform the BI-SYNC adapter to turn the line around again. If this character is garbled, either by noise, or by a transmission to TSO, the communications system locks up, and can only be restored by manually resetting the Modem at Houston. So, when this happens, hang up, log on with a different user ID, and use the PORTS command to find the port number to which you were attached. Once in a while the line clears itself, but if not, send a message to the operator, with the SEND command, explaining that you were working in such-and-such an ID, and locked up the communications system, so you logged onto the system with your present number to ask him to reset the modem you were attached to, no underscore.

M6800 FORTRAN CROSS ASSEMBLER PROGRAM LISTING

```
00010           IMPLICIT INTEGER *2(A-Z)
00020           INTEGER*4 VAL,C0UNT,C,VALUE(500),IG0,K2,KG0
00030           C0MM0N /INS/ INS(5,256)
00040           DIMENSION LINE(80), BUF(12), PUNCH(50), LABEL(5,500), IN(5)
00050           INTEGER*2 TABLE(16) /'0', '1', '2','3','4','5','6','7','8','9',
00060          $  'A','B','C','D','E','F'/
00070          $, NAME(58)/58*' '/
00080           INTEGER*2 T(64) /' ','!','"','#','$','%','&',''','(',')',
00090          $ '*','+',',','-','.','/','0','1','2','3','4','5','6','7','8','9',
00100          $':',';','<','=','>','?','@','A','B','C','D','E','F','G','H',
00110          $'I','J','K','L','M','N','0','P','Q','R','S','T','U','V','W','X',
00120          $'Y','Z','[','\',']','^','_'/
00130           DATA AST/'**'/,E/'E'/,N/'N'/,ZER0/'0'/,R/'R'/,A/'A'/,CC/'C'/,
00140          $  PL/'+'/,BL/' '/,D0/'$'/,Q/'Q'/,I/'I'/,0/'0'/,D/'D'/,N/'N'/
00150          $,AP0S/''''/,AT/'@'/
00160           LABP=1
00170           C0UNT=0
00180     C
00190     C     PICKUP NEXT ADDRESS
00200           READ(3,13,END=14)C0UNT
00210     13    F0RMAT(Z4,1X,5A1)
00220     14    CSAV=C0UNT
00230     C
00240     C     PASS 1
00250_    1     READ(1,2,END=29)LINE
```

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CIRCLE INQUIRY NO. 94

SC/MP WORD GAME — WORD G

By Sou Nam Kim

INTRODUCTION

The SC/MP word game is playable between two persons. One person, Player A, enters a word of no longer than 10 letters. The output terminal prints the first input character followed by question marks (?) for each remaining input characters. Entry is terminated by a carriage return. The terminal then prints the number of characters immediately following the last question mark followed by a line number (1) at the beginning of the next line.

Player B tries to guess the word by typing in one of the words printed out. The entry is terminated by hitting the space bar. At this time the terminal prints all the correct characters in corresponding positions. Question marks are printed in place of mismatch. Last the terminal types either LO or HI (for low or high). The program looks at the first mismatched character and determines if the guess was high or low tabulated in alphabetical order.

Player B is given nine more chances to guess remaining characters. At the end the computer prints out the correct word and a message. There are various messages for incorrect entries and praises for early guesses.

MEMORY REQUIREMENTS

The program fits into 1K byte storage. It may also fit into 2 mm 5204 or in RAM. In addition this program requires about 34 bytes of temporary data storage location. Presently it occupies RAM locations between HEX 816 and HEX 837. By changing five locations in the program, it can be moved elsewhere. The five locations are 1,6F, 103, 136, and 1E7. This program resides between 0 and 3FD.

RUNNING WORD G

The beginning address of the program is 00 therefore the program will start automatically at power up or can be restarted by resetting the processor. The program is written around a TV typewriter which has 32 character by 16 line format. When used with the TV typewriter circuit it performs automatic screen erase and cursor positioning at the beginning of each game.

EXAMPLES OF WORD G

SC/MP WORD GAME PROGRAM FLOW

1. At powerup, a message is displayed on how to play the game.
2. As the Player A enters a secret word the screen is erased and the word is displayed on top of the screen. It tests for non alphabetic characters. A more than 10-character word, and a space and prints appropriate message.
3. For a legal word entry it prints the first character and '?' in place of rest of the characters.
4. When a space is detected it recognizes the end of the entry and prints the number of total characters entered.
5. Then it prints a line number beginning with 1 on the next line and waits for Player B input.
6. As the Player B enters his guess word it stores them in memory for later comparison as well as echoing them on the screen.
7. At the same time it counts the number of character entry and if it exceeds 15 characters it terminates entry and prints message. Then it prints the next line number.
8. It recognizes the end of entry by detecting a space. At this time it compares the two word sizes and if mismatching, print a message and go to the next line.
9. If there is a word size matching then it proceeds to character matching. For each matching character it displays the character and '?' is printed in place of non-matching character.
10. For the first non-matching character it compares the two characters to determine if the guess character is higher or lower than secret character in ASCII. For example B is higher than A.
11. It proceeds with comparing characters to the end. Comparison of high or low is made for the first matching character only. At the end it prints—and HI or LO message depending on the result of the previous comparison.
12. Then it moves to the next line and prints next line number waiting for the next guess entry.
13. There are 3 types of messages printed when the correct guess is made:
    When guessed in 3 or less tries;
    You answered correctly.
    You are a genius!
    When guessed in 6 or less tries;
    You answered correctly.
    Terrific!
    For the rest . . . just;
    You answered correctly.
    When not guessed correctly in 10 tries it prints:
    Sorry you lose.
    The correct answer is 'SEXYLEG'
14. The space is not allowed as a part of an entry word as it regards the space as the termination of an entry.
15: The program detects non alphabetical characters and prints a message.
16. There are numerous other messages which make the word game more interesting.

WORD G PROGRAM ASSEMBLY LISTING

```
G
WORD GAME
PLAYER-A:ENTER A WORD OF UP TO
10 LETTERS,THEN HIT SPACE BAR
PLAYER-B:ENTER YOUR BEST GUESS
  W?????????
ALPHABET ONLY.TRY AGAIN CUTIE
  W?????????
1 GFFFFFFFF /W???F????F-LO
2 HIIIIIIIF /W???F?I?F-LO
3 WOOOFOIOF
INCORRECT WORD SIZE,DUMMY.
4 WOOOFOIOF /WO??F?I?F-HI
5 WOHUFUUUU /WO??F?I??-LO
6 WOLAFAIAF /WOL?F?I?F-LO
7 WOLFFMISF /WOL?F?I?F-LO
U HAVE 3 CHANCES LEFT.GOOD LUCK
8 WOLLFKINF /WOL?FKINF-LO
9 WOLVFKINF /WOLVFKINF-
YOU ANSWERED CORRECTLY.

  W?????????:
1 WFFFFFFFFF /W?????????F-LO
2 WIIIIIIIIF /W??????I?F-LO
3 WOOOOOOIOF /WO?????I?F-HI
4 WOLUUUUIUF /WOL????I?F-HI
5 WOLKAAAIAF /WOL??A?I?F-HI
6 WOLFNANINF /WOLF?A?I?F-LO
7 WOLFTAKINF /WOLF?A?I?F-HI
U HAVE 3 CHANCES LEFT.GOOD LUCK
8 WOLFFASINF /WOLFFA?I?F-HI
9 WOLFFALITF /WOLFFA?ITF-LO
U WOLFFAMITF /WOLFFAMITF-
YOU ANSWERED CORRECTLY.

  W?????????
1 WOMANKING /WO?????N?-HI
2 WONDERFUL /WO??????N?-HI
3 WOLVINNF /WOL????NF-HI
4 WOLFFAFNF /WOLF???NF-LO
5 WOLFSHONF /WOLFS??NF-HI
6 WOLFSDANF /WOLFS?ANF-HI
```

```
7 WOLFSCANF /WOLFS?ANF-HI
U HAVE 3 CHANCES LEFT.GOOD LUCK
K WOLFSHANF /WOLFSHANF-
YOU ANSWERED CORRECTLY.
```

```
                        TITLE WORDG  SCRMB WORD GAME
                       ;
                       ;THIS PROGRAM TAKES ABOUT 1K BYTES OF PROGRAM STORAG
                       ;WITH LOCATION ZERO.  IT ALSO USES ABOUT 34 RAM LOCAT
                       ;TEMPORARY STORAGE PURPOSES BETWEEN X'414 AND X'437
                       ;HAS BEEN LOADED INTO A PAIR OF MM4001 ROMS FOR PERM
                       ;ARE.  THE PROGRAM WAS WRITTEN AROUND A TV TYPEWRITE
                       ;HAS A 32 CHARACTER BY 16 LINE SCREEN FORMAT
                       ;
0001                   P1      =1
0002                   P2      =2
0003                   P3      =3
0821                   WORD    =0821
0070                   PSPTR   =070
0000                    =0
0000 08                NOP
                       ;
                       ;PRINT BEGINNING OF GAME MESSAGE
                       ;
0001 C408   BEG        LDI     8
0003 36                XPAH    P2
0004 C420              LDI     020
0006 32                XPAL    P2
0007 C402              LDI     H(PUTC)
0009 37                XPAH    P3
000A C49B              LDI     L(PUTC)-1
000C 33                XPAL    P3
000D C4C8              LDI     L(MBEG)
000F 31                XPAL    P1
0010 C403              LDI     H(MBEG)
0012 35                XPAH    P1
0013 C501   N1         LD      @1(P1)
0015 3F                XPPC    P3
0016 31                XPAL    P1
0017 CAFA              ST      -6(P2)
0019 E403              XRI     3
001B 9805              JZ      TAG
001D CAFA              LD      -6(P2)
001F 31                XPAL    P1
0020 90F1              JMP     N1
                       ;
                       ;BEGINNING OF GAME  IF NO THE POINT OF RETURN IS EQU
0022 C400   TAG        LDI     00
0024 3F                XPPC    P2
0025 C40A              LDI     0A
0027 3F                XPPC    P3
0028 C420              LDI     020
002A 3F                XPPC    P3
002B C420              LDI     020
002D 3F                XPPC    P3
002E C400              LDI     0
0030 CAFA              ST      -1(P2)
                       ;
                       ;GET CHARACTER, DO NOT ECHO  REFER TO SCRMB LODS LIS
                       ;COMMENTS
                       ;
0032 C408   GETC       LDI     8
0034 CAFF              ST      -1(P2)
0036 06     GRET       CSA
0037 D420              ANI     020
0039 9CFB              JNZ     GRET
003B C457              LDI     57
003D 8F04              DLY     4
003F 06                CSA
0040 D420              ANI     020
0042 9CF2              JNZ     GRET
0044 C47F   GLOOP      LDI     17F
0046 8F09              DLY     9
0048 06                CSA
0049 D420              ANI     020
004B 9802              JZ      BZ
004D C401              LDI     1
004F CAFF   BZ         ST      -1(P2)
0051 1F                RRL
0052 01                XAE
0053 1D                SRL
0054 01                XAE
0055 BAFF              DLD     -1(P2)
0057 9CEB              JNZ     GLOOP
0059 40                LDE
005A D47F              ANI     07F
005C 01                XAE
005D C3FA              LD      -1(P2)
005F 9C14              JNZ     NENTRY
                       ;
                       ;FIRST CHARACTER OF SECRET WORD IS ENTERED
                       ;
0061 C450   FENTRY     LDI     050
0063 01                XAE
0064 19                SIO
0065 19                SIO
0066 19                SIO
0067 19                SIO
0068 01                XAE
0069 CAF6              ST      -10(P2)
006B C421              LDI     L(WORD)
006D 31                XPAL    P1
006E C408              LDI     H(WORD)
0070 35                XPAH    P1
0071 C400              LDI     0
0073 CAF9              ST      -7(P2)
                       ;
                       ;REMAINING CHARACTERS OF SECRET WORD ARE ENTERED
                       ;TEST FOR SPACE  #  AND ALPHABET
                       ;
0075 C420   NENTRY     LDI     020
0077 60                XRE
0078 985A              JZ      TSPACE
007A C424              LDI     #
007C A0                XRE
007D 9844              JZ      ENT
007F C440              LDI     @
0081 03                SCL
0082 78                CAE
0083 943A              BP      NOALP
0085 03                SCL
0086 C45B              LDI     Z'+1
0088 78                CAE
0089 9402              JP      ALPHA
008B 9032              JMP     NOALP
                       ;
                       ;STORE CHARACTERS IN MEMORY  TEST FOR LIMIT IN WORD
                       ;PRINT 1ST CHARACTER AND  ?  FOR ALL OTHERS  E.G.  G?
                       ;GAME
                       ;
008D 40     ALPHA      LDE
008E CD01              ST      @1(P1)
0090 AAF8              ILD     -7(P2)
0092 E40B              XRI     11
0094 9806              JZ      EXCED
0096 E40A              XRI     10
0098 9C04              JNZ     NOF
009A 40                LDE
009B 3F     PGEC       XPPC    P3
009C 9094              JMP     GETC
009E C43F   NOF        LDI     '?
00A0 90F9              JMP     PGEC
                       ;
                       ;WORDE SIZE EXCEDED, PRINT ERROR MESSAGE AND RETURN
                       ;BEGINNING
                       ;
00A2 C432   EXCED      LDI     L(MEXC)
00A4 31                XPAL    P1
00A5 C403              LDI     H(MEXC)
00A7 35                XPAH    P1
00A8 C501   N2         LD      @1(P1)
00AA 3F                XPPC    P3
00AB 31                XPAL    P1
00AC CAFA              ST      -6(P2)
00AE E44C              XRI     L(MNAL)
00B0 9805              JZ      TAG1
00B2 C2FA              LD      -6(P2)
00B4 31                XPAL    P1
00B5 90F1              JMP     N2
00B7 C400   TAG1       LDI     0
00B9 35                XPAH    P1
00BA C470              LDI     070
00BC 31                XPAL    P1
00BD 91B1              JMP     TAG-PSPTR(P1)
                       ;
                       ;CHARACTERS OTHER THAN ALPHABET ENTERED, PRINT ERROR
                       ;
00BF C44C   NOALP      LDI     L(MNAL)
00C1 31                XPAL    P1
00C2 C403              LDI     H(MNAL)
00C4 35                XPAH    P1
00C5 C501   N3         LD      @1(P1)
00C7 3F                XPPC    P3
00C8 31                XPAL    P1
00C9 CAFA              ST      -6(P2)
00CB E46B              XRI     L(MMW)
00CD 98E8              JZ      TAG1
00CF C2FA              LD      -6(P2)
00D1 31                XPAL    P1
00D2 90F1              JMP     N3
                       ;
                       ;FIRST SECRET LETTER ENTERED IS SPACE  PRINT ERROR M
                       ;IF NOT PRINT NUMBER OF CHARACTERS
00D4 C2F9   TSPACE     LD      -7(P2)
00D6 E400              XRI     0
00D8 98E5              JZ      NOALP
00DA 02                CCL
00DB DC30              ORI     030
00DD 3F                XPPC    P3
00DE C400              LDI     0
00E0 CAF6              ST      -10(P2)
                       ;
                       ;ENTER SPACE AT END OF SECRET WORD  UPDATE LINE COUN
                       ;BER OF GUESS ) AND PRINT
                       ;
00E2 C40D   SPACE      LDI     0D
00E4 3F                XPPC    P3
00E5 C40A              LDI     0A
00E7 3F                XPPC    P3
00E8 AAF6              ILD     -10(P2)
00EA 02                CCL
00EB F430              ADI     030
00ED E43A              XRI     03A
00EF 9805              JZ      TEN
00F1 E43A              XRI     03A
00F3 3F                XPPC    P3
00F4 9003              JMP     COUNT
00F6 C430   TEN        LDI     0
00F8 3F                XPPC    P3
                       ;
                       ;TEST GUESS WORD FOR #, SPACE, AND SIZE  PUT IN TEMP
                       ;
00F9 C420   COUNT      LDI     020
00FB 3F                XPPC    P3
00FC C400              LDI     0
00FE CAF8              ST      -8(P2)
0100 CAF7              ST      -9(P2)
0102 C408              LDI     H(WORD)
0104 35                XPAH    P1
0105 C421              LDI     L(WORD)+1
0107 31                XPAL    P1
0108 C402   N4         JS      P3,GECO
     010A 37C4
     010C 5C33
     010E 3F
010F C47F              LDI     07F
0111 60                XRE
0112 98F4              JZ      N4
0114 C424              LDI     #
0116 60                XRE
0117 989E              JZ      TAG1
0119 C420              LDI     020
011B 60                XRE
011C 980B              JZ      NSPCE
011E 40                LDE
011F CD01              ST      @1(P1)
0121 AAF8              ILD     -8(P2)
0123 E40F              XRI     15
0125 984D              JZ      IMW
0127 90DF              JMP     N4
                       ;
                       ;COMPARE SIZE OF SECRET AND GUESS WORD THEN COMPARE C
                       ;BY CHARACTER  PRINT CHARACTER IF MATCHING AND  ?  IF
```

```
237                 ;MATCHING
238                 ;
239 0129 C2F9  NSPCE   LD      -7(P2)
240 012B 01            XAE
241 012C C2F8          LD      -8(P2)
242 012E 60            XRE
243 012F 9043          JNZ     IMW
244 0131 C400          LDI     0
245 0133 CAF8          ST      -8(P2)
246 0135 C408          LDI     H(WORD)
247 0137 35            XPAH    P1
248 0138 C421          LDI     L(WORD)
249 013A 31            XPAL    P1
250 013B C402          LDI     H(PUTC)
251 013D 37            XPAH    P3
252 013E C49B          LDI     L(PUTC)-1
253 0140 33            XPAL    P3
254 0141 C42F          LDI     '/'
255 0143 3F            XPPC    P3
256 0144 C501  N6      LD      @1(P1)
257 0146 01            XAE
258 0147 C109          LD      9(P1)
259 0149 60            XRE
260 014A 9824          JZ      CMATCH
261 014C C43F          LDI     '?'
262 014E 3F            XPPC    P3
263 014F C2F7          LD      -9(P2)
264 0151 9013          JNZ     TLASC
265 0153 C1FF          LD      -1(P1)
266 0155 01            XAE
267 0156 C109          LD      9(P1)
268 0158 03            SCL
269 0159 78            CAE
270 015A 9406          JP      HIGH
271 015C C401          LDI     1
272 015E CAF7          ST      -9(P2)
273 0160 9004          JMP     TLASC
274 0162 C402  HIGH    LDI     2
275 0164 CAF7          ST      -9(P2)
276                 ;
277                 ;TEST FOR COMPLETION OF COMPARISON
278                 ;
279 0166 AAF8  TLASC   ILD     -8(P2)
280 0168 01            XAE
281 0169 C2F9          LD      -7(P2)
282 016B 60            XRE
283 016C 9821          JZ      PMESS
284 016E 90D4          JMP     N6
285 0170 40    CMATCH  LDE
286 0171 3F            XPPC    P3
287 0172 90F2          JMP     TLASC
288                 ;
289                 ;ERROR MESSAGE FOR INCORRECT WORD SIZE
290                 ;
291 0174 C4AB  IMW     LDI     L(MIMW)
292 0176 31            XPAL    P1
293 0177 C403          LDI     H(MIMW)
294 0179 35            XPAH    P1
295 017A C402          LDI     H(PUTC)
296 017C 37            XPAH    P3
297 017D C49B          LDI     L(PUTC)-1
298 017F 33            XPAL    P3
299 0180 C501  N5      LD      @1(P1)
300 0182 3F            XPPC    P3
301 0183 31            XPAL    P1
302 0184 CAFA          ST      -6(P2)
303 0186 E487          XRI     L(MGL)
304 0188 981E          JZ      NGC
305 018A C2FA          LD      -6(P2)
306 018C 31            XPAL    P1
307 018D 90F1          JMP     N5
308                 ;
309                 ;PRINT 'LO - HI  MESSAGE; GOOD LUCK MESSAGE AT THE EN
310                 ;TRY AND SORRY YOU LOOSE MESSAGE AT THE END OF 10TH T
311                 ;
312 018F C42D  PMESS   LDI     02D
313 0191 3F            XPPC    P3
314 0192 C2F7          LD      -9(P2)
315 0194 987A          JZ      CORRA
316 0196 E401          XRI     1
317 0198 9C08          JNZ     MHI
318 019A C44C          LDI     'L'
319 019C 3F            XPPC    P3
320 019D C44F          LDI     'O'
321 019F 3F            XPPC    P3
322 01A0 9006          JMP     NGL
323 01A2 C448  MHI     LDI     'H'
324 01A4 3F            XPPC    P3
325 01A5 C449          LDI     'I'
326 01A7 3F            XPPC    P3
327 01A8 C2F6  NGC     LD      -10(P2)
328 01AA E407          XRI     7
329 01AC 980E          JZ      GL
330 01AE C2F6          LD      -10(P2)
331 01B0 E40A          XRI     10
332 01B2 981D          JZ      SUL
333                 ;
334                 ;JUMP BACK AND WAIT FOR NEXT GUESS WORD ENTRY
335                 ;
336 01B4 C400  SPACE1  LDI     0
337 01B6 35            XPAH    P1
338 01B7 C470          LDI     070
339 01B9 31            XPAL    P1
340 01BA 9171          JMP     SPACE-PSPTG(P1)
341                 ;
342                 ;PRINT '-------GOOD LUCK!  MESSAGE
343                 ;
344 01BC C487  GL      LDI     L(MGL)
345 01BE 31            XPAL    P1
346 01BF C403          LDI     H(MGL)
347 01C1 35            XPAH    P1
348 01C2 C501  N7      LD      @1(P1)
349 01C4 3F            XPPC    P3
350 01C5 31            XPAL    P1
351 01C6 CAFA          ST      -6(P2)
352 01C8 E4A8          XRI     L(MSUL)
353 01CA 98E8          JZ      SPACE1
354 01CC C2FA          LD      -6(P2)
355 01CE 31            XPAL    P1
356 01CF 90F1          JMP     N7
357
358                 PRINT 'SORRY YOU LOSE-------' MESSAGE
359
360 01D1 C4A8  SUL     LDI     L(MSUL)
361 01D3 31            XPAL    P1
362 01D4 C403          LDI     H(MSUL)
363 01D6 35            XPAH    P1
364 01D7 C501  N8:     LD      @1(P1)
365 01D9 3F            XPPC    P3
366 01DA 31            XPAL    P1
367 01DB CAFA          ST      -6(P2)
368 01DD E4CB          XRI     L(MCOA1)+2
369 01DF 9805          JZ      SECW
370 01E1 C2FA          LD      -6(P2)
371 01E3 31            XPAL    P1
372 01E4 90F1          JMP     N8
373                 ;
374                 ;PRINT 'THE SECRET WORD IS *SECRET*' MESSAGE
375                 ;
376 01E6 C408  SECW:   LDI     H(WORD)
377 01E8 35            XPAH    P1
378 01E9 C421          LDI     L(WORD)
379 01EB 31            XPAL    P1
380 01EC C42A          LDI     '*'
381 01EE 3F            XPPC    P3
382 01EF C501  N9      LD      @1(P1)
383 01F1 3F            XPPC    P3
384 01F2 31            XPAL    P1
385 01F3 CAFA          ST      -6(P2)
386 01F5 C2F9          LD      -7(P2)
387 01F7 02            CCL
388 01F8 F421          ADI     L(WORD)
389 01FA 01            XAE
390 01FB C2FA          LD      -6(P2)
391 01FD 60            XRE
392 01FE 9805          JZ      ESEC
393 0200 C2FA          LD      -6(P2)
394 0202 31            XPAL    P1
395 0203 90EA          JMP     N9
396 0205 C42A  ESEC    LDI     '*'
397 0207 3F            XPPC    P3
398                 ;
399                 ;SET POINTER TO JUMP TO BEGINNING OF GAME
400                 ;
401 0208 C400  TAG2    LDI     0
402 020A 35            XPAH    P1
403 020B C470          LDI     070
404 020D 31            XPAL    P1
405 020E 91B1          JMP     TAG-PSPTG(P1)
406                 ;
407                 ;PRINT 'YOU ANSWERED CORRECTLY' MESSAGE
408                 ;
409 0210 C4C9  CORRA   LDI     L(MCOA1)
410 0212 31            XPAL    P1
411 0213 C403          LDI     H(MCOA1)
412 0215 35            XPAH    P1
413 0216 C501  N10     LD      @1(P1)
414 0218 3F            XPPC    P3
415 0219 31      XPAL    P1
416 021A CAFA          ST      -6(P2)
417 021C E4E4          XRI     L(MCOA2)
418 021E 9805          JZ      SCORE
419 0220 C2FA          LD      -6(P2)
420 0222 31            XPAL    P1
421 0223 90F1          JMP     N10
422                 ;
423                 ;PRINT 'YOU ARE A GENIUS  MESSAGE IF GUESSED
424                 ;IN LESS THAN 3 TRIES
425                 ;
426 0225 C2F6  SCORE   LD      -10(P2)
427 0227 03            SCL
428 0228 FC03          CAI     3
429 022A 9415          JP      NSCORE
430 022C C4E4          LDI     L(MCOA2)
431 022E 31            XPAL    P1
432 022F C403          LDI     H(MCOA2)
433 0231 35            XPAH    P1
434 0232 C501  N11     LD      @1(P1)
435 0234 3F            XPPC    P3
436 0235 31            XPAL    P1
437 0236 CAFA          ST      -6(P2)
438 0238 E4F5          XRI     L(MCOA3)
439 023A 98CC          JZ      TAG2
440 023C C2FA          LD      -6(P2)
441 023E 31            XPAL    P1
442 023F 90F1          JMP     N11
443                 ;
444                 ;PRINT 'TERRIFIC' MESSAGE IF GUESSED IN LESS THAN 7 T
445                 ;
446 0241 C2F6  NSCORE  LD      -10(P2)
447 0243 03            SCL
448 0244 FC06          CAI     6
449 0246 94C0          JP      TAG2
450 0248 C4F5          LDI     L(MCOA3)
451 024A 31            XPAL    P1
452 024B C403          LDI     H(MCOA3)
453 024D 35            XPAH    P1
454 024E C501  N12:    LD      @1(P1)
455 0250 3F            XPPC    P3
456 0251 31            XPAL    P1
457 0252 CAFA          ST      -6(P2)
458 0254 E4FE          XRI     L(MEND)
459 0256 98B0          JZ      TAG2
460 0258 C2FA          LD      -6(P2)
461 025A 31            XPAL    P1
462 025B 90F1          JMP     N12
463
                        PAGE    'GECO'
464                     LOCAL
465 025D C408  GECO    LDI     8
466 025F CAFF          ST      -1(P2)
467 0261 06    $2      CSA
468 0262 D420          ANI     020
469 0264 9CFB          JNZ     $2
470 0266 C457          LDI     87
471 0268 8F04          DLY     4
472 026A 06            CSA
473 026B D420          ANI     020
474 026D 9CF2          JNZ     $2
475 026F 07            CAS
476 0270 DC01          ORI     1
477 0272 07            CAS
478 0273 C47E  $LOOP   LDI     126
479 0275 8F08          DLY     8
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0277 06          CSA
0278 D420        ANI     020
027A 9802        JZ      $3
027C C401        LDI     1
027E CAFE  $3    ST      -2(P2)
0280 1F          RRL
0281 01          XAE
0282 1D          SRL
0283 01          XAE
0284 06          CSA
0285 DC01        ORI     1
0287 E2FE        XOR     -2(P2)
0289 07          CAS
028A BAFF        DLD     -1(P2)
028C 9CE5        JNZ     $LOOP
028E 06          CSA
028F D4FE        ANI     0FE
0291 07          CAS
0292 8F08        DLY     8
0294 40          LDE
0295 D47F        ANI     07F
0297 01          XAE
0298 40          LDE
0299 3F          XPPC    P3
029A 90C1        JMP     GECO

                 PAGE    'PUTC'
                 LOCAL
029C 01    PUTC  XAE
029D C4FF        LDI     255
029F 8F17        DLY     23
02A1 06          CSA
02A2 DC01        ORI     1
02A4 07          CAS
02A5 C409        LDI     9
02A7 CAFF        ST      -1(P2)
02A9 C48A  $1    LDI     138
02AB 8F08        DLY     8
02AD BAFF        DLD     -1(P2)
02AF 9810        JZ      $EXIT
02B1 40          LDE
02B2 D401        ANI     1
02B4 CAFE        ST      -2(P2)
02B6 01          XAE
02B7 1C          SR
02B8 01          XAE
02B9 06          CSA
02BA DC01        ORI     1
02BC E2FE        XOR     -2(P2)
02BE 07          CAS
02BF 90E8        JMP     $1
02C1 06    $EXIT CSA
02C2 D4FE        ANI     0FE
02C4 07          CAS
02C5 3F          XPPC    P3
02C6 90D4        JMP     PUTC
02C8 0D0A  MBEG  .DBYTE X'0D0A'
02CA 574F        .ASCII  'WORD GAME
02CC 5244
02CE 2047
02D0 414D
02D2 45
02D3 0D0A        .DBYTE X'0D0A'
02D5 504C        .ASCII  'PLAYER-A ENTER A WORD OF UP TO
02D7 4159
02D9 4552
02DB 2D41
02DD 3A45
02DF 4E54
02E1 4552
02E3 2041
02E5 2057
02E7 4F52
02E9 4420
02EB 4F46
02ED 2055
02EF 5020
02F1 544F
02F3 0D0A        .DBYTE X'0D0A'
02F5 3130        .ASCII  '10 LETTERS, THEN HIT SPACE BAR
02F7 204C
02F9 4554
02FB 5445
02FD 5253
02FF 2C54
0301 4845
0303 4E20
0305 4849
0307 5420
0309 5350
030B 4143
030D 4520
030F 4241
0311 52
0312 0D0A        .DBYTE X'0D0A'
0314 504C        .ASCII  'PLAYER-B ENTER YOUR BEST GUESS
0316 4159
0318 4552
031A 2D42
031C 3A45
031E 4E54
0320 4552
0322 2059
0324 4F55
0326 5220
0328 4245
032A 5354
032C 2047
032E 5545
0330 5353
0332 0D0A  MEXC  .DBYTE X'0D0A'
0334 4C49        .ASCII  'LIMIT EXCEEDED, WISE GUY
0336 4D49
0338 5420
033A 4558
033C 4345
033E 4544
0340 4544
0342 2C57
0344 4953
0346 4520
0348 4755
034A 592E
034C 0D0A  MNAL  .DBYTE X'0D0A'
034E 414C        .ASCII  'ALPHABET ONLY TRY AGAIN CUTIE
0350 5048
0352 4142
0354 4554
0356 204F
0358 4E4C
035A 592E
035C 5452
035E 5920
0360 4147
0362 4149
0364 4E20
0366 4355
0368 5449
036A 45
036B 0D0A  MIMW  .DBYTE X'0D0A'
036D 494E        .ASCII  'INCORRECT WORD SIZE, DUMMY
036F 434F
0371 5252
0373 4543
0375 5420
0377 574F
0379 5244
037B 2053
037D 495A
037F 4520
0381 4455
0383 4D4D
0385 592E
0387 0D0A  MGL   .DBYTE X'0D0A'
0389 5520        .ASCII  'U HAVE 3 CHANCES LEFT GOOD LUCK
038B 4841
038D 5645
038F 2033
0391 2043
0393 4841
0395 4E43
0397 4553
0399 204C
039B 4546
039D 542E
039F 474F
03A1 4F44
03A3 204C
03A5 5543
03A7 4B
03A8 0D0A  MSUL  .DBYTE X'0D0A'
03AA 534F        .ASCII  'SORRY U LOSE THE SECRET WORD IS
03AC 5252
03AE 5920
03B0 5520
03B2 4C4F
03B4 5345
03B6 2E54
03B8 4845
03BA 2053
03BC 4543
03BE 5245
03C0 5420
03C2 574F
03C4 5244
03C6 2049
03C8 53
03C9 0D0A  MC0A1 .DBYTE X'0D0A'
03CB 594F        .ASCII  'YOU ANSWERED CORRECTLY
03CD 5520
03CF 414E
03D1 5357
03D3 4552
03D5 4544
03D7 2043
03D9 4F52
03DB 5245
03DD 4354
03DF 4C59
03E1 2E
03E2 0D0A        .DBYTE X'0D0A'
03E4 594F  MC0A2 .ASCII  'YOU ARE A GENIUS.
03E6 5520
03E8 4152
03EA 4520
03EC 4120
03EE 4745
03F0 4E49
03F2 5553
03F4 2E
03F5 5445  MC0A3 .ASCII  'TERRIFIC!
03F7 5252
03F9 4946
03FB 4943
03FD 21
0000  MEND:  END
```

ALPHA	008D	BEG	0001 *	BZ	004F
CMATCH	0170	CORRA	0210	COUNT	00F9
ESEC	0205	EXCED	00A2	FENTRY	0061
GECO	025D	GETC	0032	GL	01BC
GLOOP	0044	GRET	0036	HIGH	0162
IMW	0174	MBEG	02C8	MC0A1	03C9
MC0A2	03E4	MC0A3	03F5	MEND	03FE
MEXC	0332	MGL	0387	MHI	01A2
MIMW	036B	MNAL	034C	MSUL	03A8
N1	0013	N10	0216	N11	0232
N12	024E	N2	00A8	N3	00C5
N4	0108	N5	0180	N6	0144
N7	01C2	N8	01D7	N9	01EF
NENTRY	0075	NGC	01A8	NOALP	00BF
NOF	009E	NSCORE	0241	NSPCE	0129
P1	0001	P2	0002	P3	0003
PGEC	009B	PMESS	018F	PSPTG	0070
PUTC	029C	SCORE	0225	SECW	01E6
SPACE	00E2	SPACE1	01B4	SUL	01D1
TAG	0022	TAG1	00B7	TAG2	0298
TEN	00F6	TLASC	0166	TSPACE	00D4
WORD	0821	$1	02A9	$2	0261
$3	027E	$EXIT	02C1	$LOOP	0273

NO ERROR LINES
SOURCE CHECKSUM=6F4E
FIRST INPUT SECTOR HEX - 0300
FINAL INPUT SECTOR HEX - 0311

SOFTWARE BUGS

This program was first published in the October issue

Biorhythm

By William T. Mitchell

One of the more visible changes which have taken place in our society over the past few years, is that an increasing number of people are taking an interest in subjects which they would have dismissed as superstitious folly only a short time ago. Transcendental Meditation is now widely practiced, and appears to be becoming more common by the day. Astrology was once almost universally regarded as pure hokum: now nearly everyone knows the sign of the Zodiac under which they were born and an increasing number of persons seem to take seriously the "influence" of the stars.

Biorhythms are another area which has seen increasing interest. One company has recently marketed a pocket calculator which will tell you the status of your Biorhythm Cycle on any given day. This article describes a BASIC program to plot anyone's Biorhythm Chart for any given time period. The chart produced is 64 columns wide, and can be displayed on a 64x16 CRT monitor if no hardcopy device is available.

The Biorhythm theory postulates that there are certain metabolic cycles, known as *inner clocks,* which have a constant period in the human body. The three main cycles are a 23-day *Physical Cycle,* a 28-day *Emotional Cycle* and a 33-day *Intellectual Cycle.* The Physical cycle is associated with physical vitality, endurance and energy level. The Emotional cycle corresponds to sensitivity, intuition and cheerfulness. The Intellectual cycle is related to mental alertness, cognitive power and judgement ability. All three cycles start at zero on the upswing at the moment of birth and continue unbroken throughout a person's lifetime.*

According to Biorhythm Theory, the high periods of a cycle are the times when a person will probably have the most energy, be most cheerful, mentally sharp, outgoing and alert. The low periods can be regarded as recuperative times, when the body is recharging its batteries. The days on which any cycle crosses the *Zero* line are called *Critical Days,* and performance may be unstable on these days.

The Biorhythm program presented in this article generally flows from top to bottom. It is divided into several distinct sections, each doing a specific job and each headed by a descriptive remark. In most cases I find it natural to program in this format. I try to stay with this format even at the cost of extra effort because it makes programs relatively easy to read and understand when I want to modify them after six months of not looking at them.

**The tenuousness of the theory hinges upon this postulated starting point. There is no "moment of birth," merely a series of steps in an ongoing process of development. The day of birth is a legal or civic rather than biological event. —ed.*

The 100 series statements initialize the program. Arrays are dimensioned, the string array T$ is loaded with the names of the days of the week, the 12-element array F is loaded with the number of days in each month and the constant K is set to 2*PI.

The 200-series statements obtain input data for the program. It is important to note here that the program requires input of the date in an unusual format, requiring the full four digit year instead of the more usual last two digits. I have found that in situations such as this it is usually a mistake to expect people to read and follow instructions, so it is best to anticipate bad input data and provide error messages and recovery where possible. In this case, if only the last two digits of the year are entered the program will correct the year to a 20th Century date and print the corrected date. I only checked the year because I felt that this was the only input parameter where unintentional error was really likely, and I wanted to conserve program space.

Because of the numerous calls we have received regarding this program, we are publishing it a second time with the author's corrections and a new listing.

The 300-series statements calculate the number of days which have elapsed between the birthdate supplied and the start of the Biorhythm chart. Leap years are taken into account and extra days are added as required. Also, since the algorithm used to calculate the day of the week is only valid for dates since September 14, 1752 (when the Gregorian calendar was introduced) P1 and P2 are reset to 8 to print a blank for the weekday name opposite dates prior to this. If you will be modifying this program or rewriting it for a different version of BASIC, this section is the most likely source of errors. When I checked an early version of this program against two Biorhythm plotters available on a local timesharing service I found that all three gave different charts. Checking further into this, I found that all three charts were wrong. I fixed the problems with my program and notified the systems managers of the timesharing service of the problems. Figure 2 is part of a typical test run, showing some of the checks which must be made to verify that the program operates properly.

The 400-series statements print the chart header and set F(2) to 29 if we're beginning plotting a leap year.

```
                    BIORYTHM CHART FOR BILL MITCHELL

                          BORN ON   TUE  3/ 2/ 1943
                          BEGINNING SUN  5/ 1/ 1977

                          P=PHYSICAL      (23 DAYS)
                          E=EMOTIONAL     (28 DAYS)
                          I=INTELLECTUAL  (33 DAYS)
                          A=OVERALL AVERAGE

                 DOWN                    CRITICAL                      UP
                 ------------------------!-------------------------
SUN    5/ 1                I             !         A       E        P
MON    5/ 2                   I          !         A E              P
TUE    5/ 3                      I       !      E A                 P
WED    5/ 4                              E       A             P
THU    5/ 5                         E     !     A            P
FRI    5/ 6                    E          !  A      IP
SAT    5/ 7               E               A  P           I
SUN    5/ 8          E                 PA !                  I
MON    5/ 9       E              P     A  !                     I
TUE    5/ 10     E         P          A    !                        I
WED    5/ 11    E     P              A     !                         I
THU    5/ 12     E                  A      !                          I
FRI    5/ 13    P E                 A      !                          I
SAT    5/ 14     P    E              A      !                         I
SUN    5/ 15       P      E            A   !                      I
MON    5/ 16            P       E        A !                  I
TUE    5/ 17                 P       E    A!              I
WED    5/ 18                    P         E A         I
THU    5/ 19                              P   A EI
FRI    5/ 20                              ! I    A    E
SAT    5/ 21                           I  !         A   P  E
SUN    5/ 22                        I     !          A       P E
MON    5/ 23                    I         !           A          PE
TUE    5/ 24               I              !           A            E
WED    5/ 25          I                   !           A             E
THU    5/ 26       I                      !           A             E
FRI    5/ 27    I                         !      A                P  E
SAT    5/ 28 I                            !    A              P   E
SUN    5/ 29 I                            A          P      E
MON    5/ 30    I                      A  !  P         E
TUE    5/ 31      I                 A   P  !      E
```

Figure 1. This is a typical biorhythm chart showing the interrelationship between the Physical, Emotional and *Intellectual* cycles.

The 500-series statements do the actual work of generating the chart. If the version of BASIC you are using does not include a SIN function, the Series 900 subroutine can be used with the modification discussed being made in Lines 535 through 580. Of course, using the Series 900 subroutine to generate the SIN function will cause the program to run much more slowly than if a BASIC SIN function is used. The actual body of the Biorhythm chart is printed in the string array O$. If access to individual characters in a string is not available, the string O$ could be eliminated and the characters to be printed sorted by position and printed with tabs.

The PRINT#4 statements in Sections 400 and 500 cause my system to print the Biorhythm Chart on a hardcopy printer. If your system has no hardcopy printer, changing these statements to simple PRINT statements should cause the chart to be displayed on the terminal's CRT monitor.

The 600-series statements increment the day, month and year counters. F(2) is reset to 28 or 29 as required for leap years.

The 700-series subroutine sets pointer P2 according to the day of the week corresponding to the date in M2, D2 and Y2.

The 800-series subroutine calculates the number of days expended in prior months of the current year.

The 900-series subroutine allows the calculation required by Lines 535, 550 and 565 of the program to be performed on systems running versions of BASIC which lack the SIN function. In order to use this subroutine, Lines 535 and 540 should be replaced with the following statements:

```
535 X = 23
536 GOSUB 900
540 O$[X*25 + 26] = "P"
```

Lines 550 through 580 should also be rewritten, calling the subroutine with X set to 28 and 33 and making the required adjustment in the pointers into the string O$.

Since completing this program, I've plotted Biorhythm Charts for most of my friends. I find that I'm watching my own chart for any correlation between my charted Biorhythms on any day and how that day actually turned out. If my experience is anything to go by, the Biorhythm plotter on your system will be one of your more often used programs.

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```
                    BIORYTHM CHART FOR NO LEAP YRS

                              BORN ON   SAT  2/ 27/ 1965
                              BEGINNING SUN  2/ 27/ 1966

                              P=PHYSICAL      (23 DAYS)
                              E=EMOTIONAL     (28 DAYS)
                              I=INTELLECTUAL  (33 DAYS)
                              A=OVERALL AVERAGE

              DOWN                    CRITICAL                    UP
              ----------------------!----------------------
SUN   2/ 27         P               A!     E  I
MON   2/ 28              P           !   A      E  I
TUE   3/ 1                    P      !        A      EI
WED   3/ 2                           P            A      E
THU   3/ 3                           !      P         A     E

                    BIORYTHM CHART FOR BEGINNING LEAP YR

                              BORN ON   THU  2/ 27/ 1964
                              BEGINNING SAT  2/ 27/ 1965

                              P=PHYSICAL      (23 DAYS)
                              E=EMOTIONAL     (28 DAYS)
                              I=INTELLECTUAL  (33 DAYS)
                              A=OVERALL AVERAGE

              DOWN                    CRITICAL                    UP
              ----------------------!----------------------
SAT   2/ 27              P           !   A      E  I
SUN   2/ 28                   P      !        A      EI
MON   3/ 1                           P            A      E
TUE   3/ 2                           !      P         A     E
WED   3/ 3                           !           P       A  E

                    BIORYTHM CHART FOR ENDING LEAP YR

                              BORN ON   WED  2/ 27/ 1963
                              BEGINNING THU  2/ 27/ 1964

                              P=PHYSICAL      (23 DAYS)
                              E=EMOTIONAL     (28 DAYS)
                              I=INTELLECTUAL  (33 DAYS)
                              A=OVERALL AVERAGE

              DOWN                    CRITICAL                    UP
              ----------------------!----------------------
THU   2/ 27         P               A!     E  I
FRI   2/ 28              P           !   A      E  I
SAT   2/ 29                   P      !        A      EI
SUN   3/ 1                           P            A      E
MON   3/ 2                           !      P         A     E
TUE   3/ 3                           !           P       A  E
```

Figure 2. This is the result of some test runs to determine that the Leap Years are being handled correctly. These tests show that the Physical cycle crosses the Zero Line 369 days after birth whether or not a Leap Year is involved.

LISTING 1 This is a listing of the Biorhythm Plotting Program

```
10  REM BIORHYTHM PLOTTING PROGRAM
120 DIM F[12],J[2],Z$[20],T$[8,3],O$[51]
130 READ T$[1],T$[2],T$[3],T$[4],T$[5],T$[6],T$[7],T$[8],K
140 DATA
    "SUN","MON","TUE","WED","THU","FRI","SAT","    ",6.28318
150 READ F[1],F[2],F[3],F[4],F[5],F[6],F[7],F[8],F[9],F[10],F[11],F[12]
160 DATA 31,28,31,30,31,30,31,31,30,31,30,31
200 REM DATA INPUT
205 PRINT "ENTER YOUR NAME: ";
210 INPUT Z$
215 PRINT "ENTER DATES IN THE FORMAT MM,DD,YYYY"
220 PRINT "EXAMPLE — JUNE 16, 1944 WOULD BE 6,16,1944"
225 PRINT
230 PRINT TAB 11;"BIRTHDATE: ";
235 INPUT M1,D1,Y1
240 IF Y1>99 THEN 255
245 Y1 = Y1 + 1900
250 PRINT TAB 25,Y1
255 M2 = M1,D2 = D1,Y2 = Y1
260 GOSUB 700
265 P1 = P2
270 PRINT "START DATE FOR CHART: ";
275 INPUT M2,D2,Y2
280 IF Y2>99 THEN 295
285 Y2 = Y2 + 1900
290 PRINT TAB 25,Y2
295 GOSUB 700
297 PRINT "LENGTH OF CHART IN DAYS: ";
298 INPUT L
300 REM CALCULATE OFFSET, CONSIDER LEAP YEARS
305 X = M1
310 GOSUB 800
315 J1 = J2 + D1 + Y1*365
320 IF J1<639723 THEN P1 = 8
325 X = M2
330 GOSUB 800
335 J2 = J2 + D2 + Y2*365
340 IF J2<639723 THEN P2 = 8
345 N1 = Y2 – .1
346 O = J2 – J1 + INT(N1/4) – INT(Y1/4) – INT(N1/100) + INT(Y1/100) +
    INT(N1/400) – INT(Y1/400)
350 IF M1>2 THEN 370
355 X = Y1
360 GOSUB 1000
365 O = O + X
370 IF M2>3 THEN 400
375 X = Y2
380 GOSUB 1000
385 O = O + X
400 REM PRINT HEADER
405 FOR I = 1 TO 5
410 PRINT#4,
415 NEXT I
420 PRINT#4,TAB 20;"BIORHYTHM CHART FOR ";Z$
425 PRINT#4,
430 PRINT#4,TAB 28;"BORN ON   ";T$[P1];"   ";M1;"/";D1;"/";Y1
435 PRINT#4,TAB 28;"BEGINNING ";T$[P2];"   ";M2;"/";D2;"/";Y2
440 PRINT#4,
445 PRINT#4,TAB 28,"P = PHYSICAL          (23 DAYS)"
450 PRINT#4,TAB 28,"E = EMOTIONAL         (28 DAYS)"
455 PRINT#4,TAB 28,"I = INTELLECTUAL      (33 DAYS)"
460 PRINT#4,TAB 28,"A = OVERALL AVERAGE"
465 PRINT#4,
470 PRINT#4,TAB 13,"DOWN";TAB 34;"CRITICAL";TAB 62;"UP"
475 PRINT#4,TAB13;"----------!----------"
480 REM SET F(2) TO 29 FOR LEAP YEARS
485 X = Y2
490 GOSUB 1000
495 F(2) = F(2) + X
500 REM GENERATE CHART
```

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```
505 L=O+L
510 C=0
515 FOR O=O TO L-1
520 C=C+1
525 O$=" ! "
530 Y=0
535 X=(SIN(K*(O/23-INT(O/23)))*25)+26
540 O$[X]="P"
545 Y=Y+X
550 X=(SIN(K*(O/33-INT(O/33)))*25)+26
555 O$[X]="I"
560 Y=Y+X
565 X=(SIN(K*(O/28-INT(O/28)))*25)+26
570 O$[X]="E"
575 Y=(Y+X)/3
580 O$[Y]="A"
585 PRINT#4,T$[P2];TAB 5;M2;"/";D2;TAB 13;O$
600 REM INCREMENT DATE
605 IF P2=8 THEN 620
610 P2=P2+1
615 IF P2>7 THEN P2=1
620 D2=D2+1
625 IF D2>F[M2] THEN D2=1,M2=M2+1
630 IF M2<13 THEN 640
635 M2=1,Y2=Y2+1
640 X=Y2,F(2)=28
645 GOSUB 1000
650 F(2)=F(2)+X
655 NEXT O
670 GOTO 205
700 REM FIND DAY OF WEEK
705 N1=M2+12*INT(.6+1/M2)
710 N2=Y2-INT(.6+1/M2)
715 N3=INT(13*(N1+1)/5)
720 N4=INT(5*N2/4)
725 N5=INT(N2/100)
730 N6=INT(N2/400)
735 N7=N3+N4-N5+N6+D2-1
740 P2=N7-7*INT(N7/7)+1
745 RETURN
800 REM FIND DAYS IN PAST MONTHS
810 J2=0
820 FOR I=1 TO X-1
830 J2=J2+F[I]
840 NEXT I
850 RETURN
1000 REM CHECK X FOR LEAP YEAR
1005 IF X/400-INT(X/400)=0 THEN 1020
1010 IF X/100-INT(X/100)=0 THEN 1030
1015 IF X/4-INT(X/4)<>0 THEN 1030
1020 X=1
1025 RETURN
1030 X=0
1035 RETURN
```

LISTING 2 This is a listing of the optional 900-series subroutine which is used on systems having no SIN function.

```
905 X=K*(O/X-INT(O/X))
910 X2=X 2,X3=X,N1=1,N2=2,N3=1
915 X4=X
920 FOR N5=N2 TO N2+1
925 N3=N3*N5
930 NEXT N5
935 N2=N5
940 X3=X3*X2,N1=-1*N1
945 X=X+N1*X3/N3
950 IF X<>X4 THEN 915
955 RETURN
```

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Random Number Program for Security Combinations

By David E. Mann

This program was originally written on a Honeywell 1108 based system with ASR-37 terminal and high-speed printer. The purpose of the program was to produce listings of five to ten thousand lines of randomly-generated combinations, for use by the vault and lock staff of the Pentagon Building. The scale-down presented here can be an effective instrument in civilian security. Though released for publication, ***this article does not reflect the views or official policy of the Department of Defense.***

—Editor

PROGRAM LISTING

```
10   PRINT
20   REM    FINAL VERSION 5 SEP 1977
30   REM    THIS PROGRAM WRITTEN BY D.E. MANN AND EXISTS IN THE PUBLIC
40   REM    DOMAIN. THERE ARE NO COPYRIGHT RESTRICTIONS OVER ITS USE.
50   PRINT "THIS PROGRAM PREPARES RANDOMLY-GENERATED NUMBERS FORMATTED"
60   PRINT "FOR USE AS SAFE, VAULT AND SECURITY CONTAINER COMBINATIONS."
70   PRINT "IT ENABLES A LOCKSMITH OR SECURITY MANAGER TO HAVE NUMBERS"
80   PRINT "FOR COMBINATIONS WHICH ARE UNRELATED TO COMPROMISING EVENTS"
90   PRINT "SUCH AS BIRTHDAYS, Etc. FOR MAXIMUM SECURITY, ONLY A"
100  PRINT "RANDOM NUMBER SHOULD BE USED WHEN CHANGING AND SETTING A"
110  PRINT "NEW COMBINATION . . . . ."
120  PRINT
130  PRINT "-------------------------------------------------------------------"
140  PRINT
150  PRINT "If you need instructions, type '1', if not type '0' "
160  PRINT
170  INPUT Z
180  IF Z = 1 THEN 400
190  IF Z = 0 THEN 200
200  PRINT
210  PRINT "How many lines of combinations do you desire?"
220  INPUT Q
230  DIM A(9)
240  FOR J = 1 TO Q
250  FOR I = 1 TO 9
260  LET A(I) = RND (-1)*100
270  NEXT I
280  PRINT
290  PRINTUSING300,A(1),A(2),A(3),A(4),A(5),A(6),A(7),A(8),A(9)
300:            ##-##-##          ##-##-##          ##-##-##
310  NEXT J
320  PRINT
330  PRINT "-------------------------------------------------------------------"
340  PRINT
350  PRINT "FOR MORE, TYPE A '1'; TO STOP TYPE '0' "
360  INPUT Y
370  IF Y = 1 THEN 200
380  IF Y = 0 THEN 540
390  REM    INSTRUCTIONS
400  PRINT
410  PRINT ". . . . .YOU MAY TYPE IN ANY POSITIVE NUMBER; REQUESTS FOR"
420  PRINT "MORE THAN 100 LINES ON A TTY MAY RESULT IN EXCESSIVE"
430  PRINT "OUTPUT TIMES."
440  PRINT
450  PRINT "ON SOME SYSTEMS, GENERATION OF RANDOM NUMBERS MAY BE"
460  PRINT "CONSTRAINED BY INATE SYSTEMS PROCEDURES WHICH REPLICATE"
470  PRINT "PREVIOUS NUMBERS PRINTED. EXAMINE LINE 260, AND"
480  PRINT "COMPARE IT WITH YOUR PARTICULAR SYSTEM INSTRUCTIONS. FOR"
490  PRINT "EXAMPLE, SOME SYSTEMS WILL NOT PRODUCE UNPREDICTABLE"
500  PRINT "RANDOM NUMBERS UNLESS A NEGATIVE ARGUMENT FOR RND"
510  PRINT "FUNCTION IS USED (E.G.: 'RND(-1)' INSTEAD OF 'RND(+)')"
520  PRINT
530  GOTO 200
540  END
```

```
THIS PROGRAM PREPARES RANDOMLY-GENERATED NUMBERS FORMATTED
FOR USE AS SAFE, VAULT AND SECURITY CONTAINER COMBINATIONS.
IT ENABLES A LOCKSMITH OR SECURITY MANAGER TO HAVE NUMBERS
FOR COMBINATIONS WHICH ARE UNRELATED TO COMPROMISING EVENTS
SUCH AS BIRTHDAYS, Etc. FOR MAXIMUM SECURITY, ONLY A
RANDOM NUMBER SHOULD BE USED WHEN CHANGING AND SETTING A
NEW COMBINATION . . . . .

-------------------------------------------------------------------

If you need instructions, type '1', if not type '0'

?
1

. . . . .YOU MAY TYPE IN ANY POSITIVE NUMBER; REQUESTS FOR
MORE THAN 100 LINES ON A TTY MAY RESULT IN EXCESSIVE
OUTPUT TIMES.

ON SOME SYSTEMS, GENERATION OF RANDOM NUMBERS MAY BE
CONSTRAINED BY INATE SYSTEMS PROCEDURES WHICH REPLICATE
PREVIOUS NUMBERS PRINTED. EXAMINE LINE 260, AND
COMPARE IT WITH YOUR PARTICULAR SYSTEM INSTRUCTIONS. FOR
EXAMPLE, SOME SYSTEMS WILL NOT PRODUCE UNPREDICTABLE
RANDOM NUMBERS UNLESS A NEGATIVE ARGUMENT FOR RND
FUNCTION IS USED (E.G.: 'RND(-1)' INSTEAD OF 'RND(+)')

How many lines of combinations do you desire?
?
10

        87-61-95          17-35-51          79-61-85
        **-30-95          26-78-52           7-78-92
        85-19-96          78-98-84          68- 7-97
        91-15-83          17-58-88          42-28-39
        74-53-31          18-92-18          63-14-92
        71-91-78          60-79-15          94-11-44
        69-78-97          98-19-81          99- 7-65
        83-34-69          38- 1-49          17- 3-83
        26-15-58           8-78-59          32-90-53
        79-89-77          29-39-25          47-20-34

-------------------------------------------------------------------

FOR MORE, TYPE A '1'; TO STOP TYPE '0'
?
1

How many lines of combinations do you desire?
?
1
```

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With Disk Capability
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Then why spend needless time and energy when we will deliver assembled and fully tested systems, like this one.

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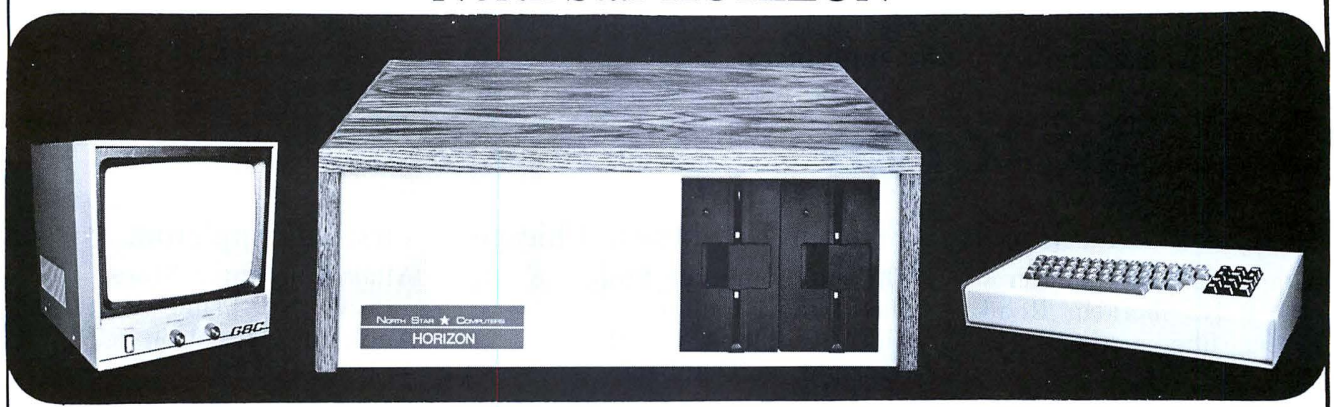
North Star HORIZON



North Star Horizon Single Drive System includes the Z-80 CPU at 2 or 4 MHz, motherboard, 16K of memory at 4 MHz and power supply. Software includes Disk Operating System and Disk BASIC. Horizon 1 kit is $1599. Dual Drive Horizon is also available at $1999.

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Video Board (64 by 16) ✦
9" Video Monitor
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CIRCLE INQUIRY NO. 83

Punch and Read Intel Formatted Tape

By G. M. Sanderson

INTRODUCTION

Intel is presently marketing an 8080 evaluation kit called the SDK-80. This kit provides a complete operating microprocessor system including:

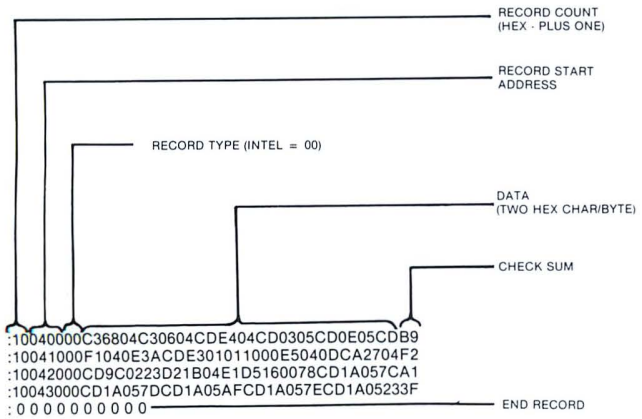
- 8080 CPU & Clock Generator
- 256 Bytes of Memory (Expandable to 1K)
- 1K Bytes of ROM (Expandable to 4K)
- 1K Bytes of EROM
- 24 Parallel I/O Lines (Expandable to 48)
- Serial Port with Baud Rate Generator
- Wirewrap Area for Expansion
- One Interrupt

INTEL MONITOR

Contained in the SDK-80 is a 1K ROM containing the operating monitor. This monitor allows you to display memory, modify memory, move memory, input to memory, display registers, modify registers, and transfer control to the user's program using a serial I/O device. Two important routines omitted from this monitor are the capability to output program to paper tape, or audio tape, and reenter programs.

INTEL FORMAT

On other Intel products Intel has utilized a tape format known as the Intel Format. Figure 1 describes this tape format.



PUNCH AND READ

The Punch and Read Program uses a slightly modified Intel format. This modified format can read almost any program designed to read Intel formatted tape. This program will read any Intel tape created on other programs. The modification to the Intel format is the addition of a header to the tape. The addition of the header allows rapid verification that the tape is the one desired.

SOFTWARE REQUIREMENTS

The Punch and Read program is designed to function with the SDK-80 monitor using the I/O drivers contained in the monitor. The program is set to 0400 to allow the SDK-80 supplied EPROM to be programmed and inserted in the second ROM/EROM socket.

OPERATING

Typing G403 <CR> enters the Punch program. The program will output a <CR> <LF> and wait for you to input the header. The header is terminated with a <CR> and must contain no ":" or less than 32 characters. The program will *out* <CR> <LF> and wait for you to input the start Address, end Address separated with a "," and ended with a <CR>. Turn on the punch prior to typing the <CR>. The program will punch a 6" leader, punch the header, punch the data from the start Address to the end Address, punch 6" leader, and then return to the monitor.

EXAMPLES

Typing G400<CR> enters the read program. (Start the tape reader.) The program will output the header allowing verification of the proper tape or segment. The program will then output only the loading Address of each record and OK if the record is valid or * if the record had a Checksum Error. Upon completing the tape segment, the program will return to the monitor.

```
Reset              MCS-80 KIT
KBD input          G403 <CR>
                   SAMPLE DUMP OF 0400 TO 047F <CR>
                   0400,047F <CR>
(turn on punch)
output to punch    SAMPLE DUMP OF 0400 TO 047F
                   :10040000C36804C30604CDE404CD0305CD0E05CDB9
                   :10041000F1040E3ACDE301011000E5040DCA2704F2
                   :10042000CD9C0223D21B04E1D5160078CD1A057CA1
                   :10043000CD1A057DCD1A05AFCD1A057ECD1A05233F
                   :1004400005C23B04AF92CD1A05D1CDEE012BCD9C58
                   :100450000223D212040E3ACDE3012605AFCD1A05D0
                   :1004600025C2C04CD0E05CFCD1B02FE00CA680478
                   :10047000FE3ACA7B04CDF401C368041600CDBD0466
                   :0000000000
                   MCS-80 KIT
                   •
Reset              MCD-80 KIT
KDB input          •G400<CR>
(turn on reader)
                   SAMPLE DUMP OF 0400 TO 047F

Any input errors   0400 OK
will be flagged    0410 OK
with *             0420 OK
                   0430 OK
                   0440 OK
                   0450 OK
                   0460 OK
                   0470 OK

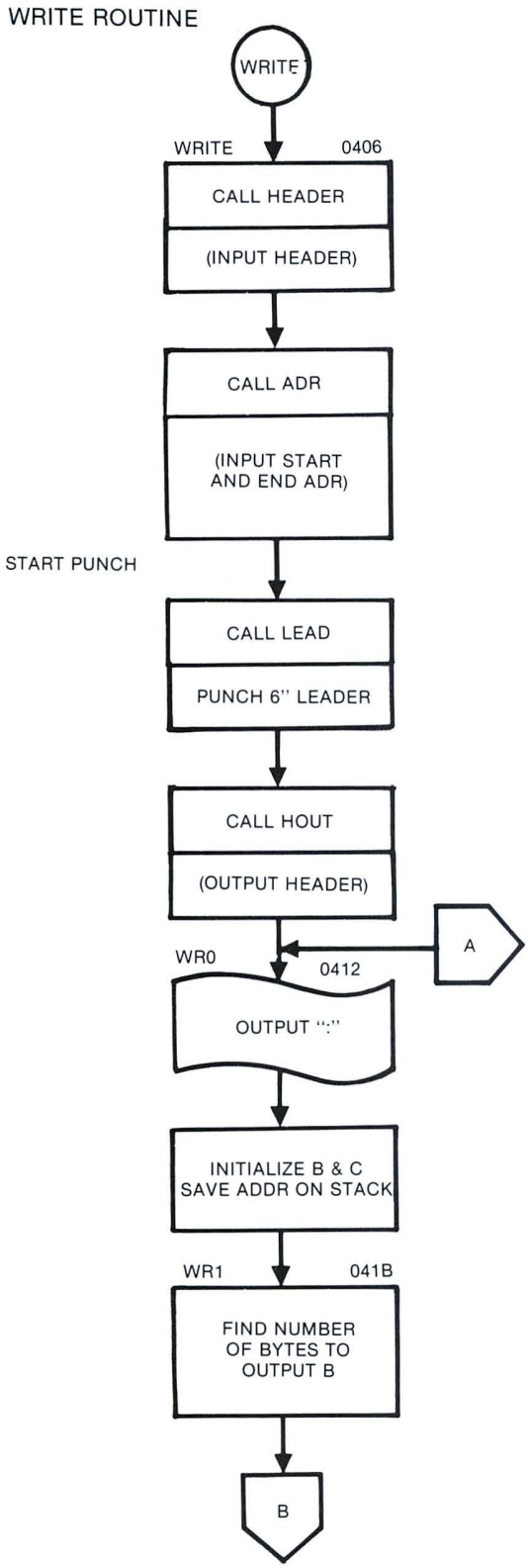
                   MCS-80 KIT

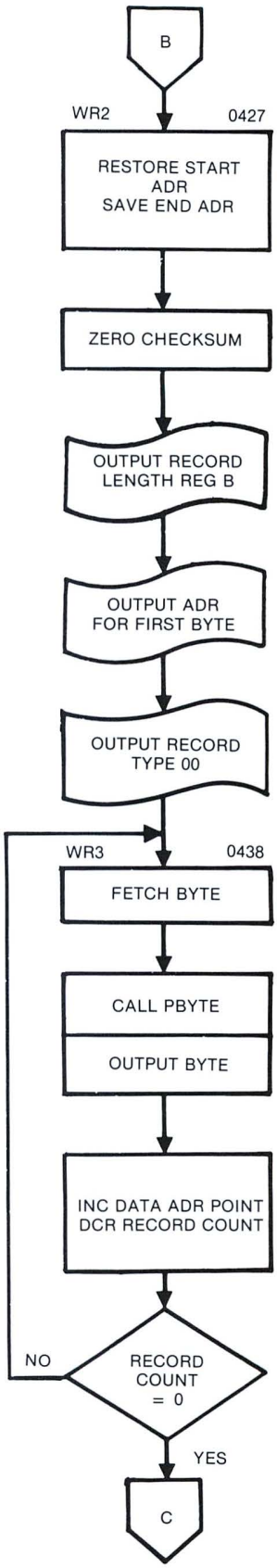
                   •
                   •
```

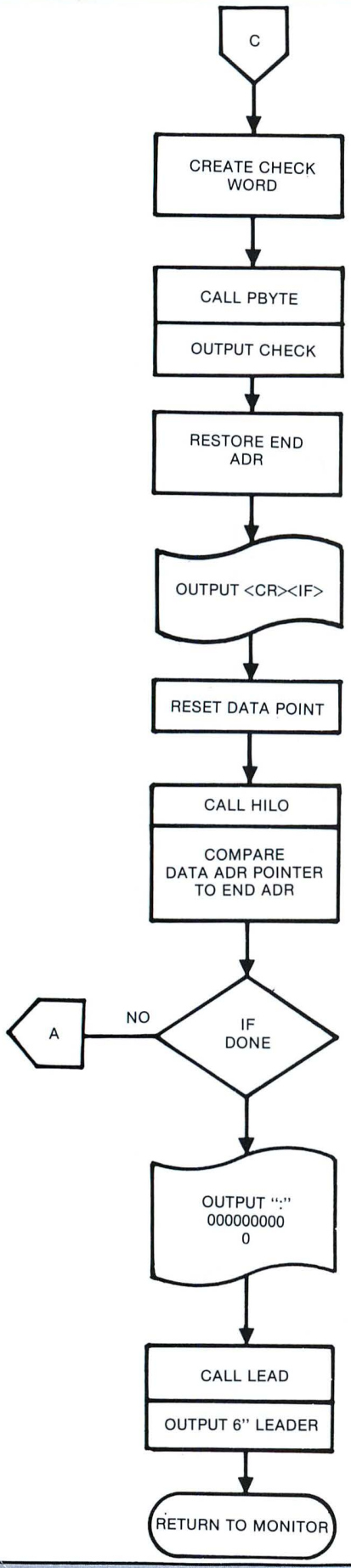
```
;*********************************************************
;*                                                       *
;*   PUNCH AND READ INTEL FØRMATED TAPE  13 MAR 77       *
;*   BY GARY SANDERSØN   VIDEØ DISPLAY CØNSULTING        *
;*                                                       *
;*   CØNFIGURATIØN:  SDK-80 KIT HARDWARE                 *
;*                   STANDARD RØM (0000-03FF)            *
;*                   EPRØM (0400-07FF)                   *
;*                   RAM   (1000-13FF)                   *
;*                                                       *
;*   MEMØRY USED:    EPRØM (0400-052C)                   *
;*                   RAM   (13B0-13D0)                   *
;*                                                       *
;*********************************************************
;*                                                       *
;* WRITE ØPERATIØN: RESET SDK-80                         *
;*                  .<G403><CR>                          *
;*                  <PGM NAME><CR>              NØTE 1&2 *
;*                  <START ADR><,><END ADR><CR> NØTE 3&5 *
;*                                                       *
;*********************************************************
;*                                                       *
;* READ ØPERATIØN: RESET SDK-80                          *
;*                 .<G400><CR>                  NØTE 4&5 *
;*                                                       *
;*********************************************************
;*                                                       *
;* NØTES: 1-PGM NAME MUST BE LESS THAN 32 CHARACTERS     *
;*        2-PGM NAME MUST NØT INCLUDE A RECØRD MARK ":"  *
;*        3-START PUNCH BEFØRE DEPRESSING CARRIAGE RTN.  *
;*        4-START READER AFTER DEPRESSING CARRIAGE RTN.  *
;*        5-AFTER ØPERATIØN IS CØMPLETED CØNTRØL WILL    *
;*          BE RETURNED TØ THE MØNITØR AND PRINT         *
;*          "MCS-80 KIT"                                 *
;*                                                       *
;*********************************************************
                        ;
                        ;
ECHØ    EQU     01F4H   ;*** SDK-80 MØNITØR RØUTINES USED ***
CØ      EQU     01E3H   ;
GETCH   EQU     021BH   ;
GETHX   EQU     0222H   ;
CNVBN   EQU     01DAH   ;
NMØUT   EQU     02C3H   ;
HILØ    EQU     029CH   ;
CRØUT   EQU     01EEH   ;
                        ;
CR      EQU     0DH     ;CARRIAGE RETURN
                        ;
        ØRG     0400H   ;
PRØM1:  JMP     READ    ;RØUTINE READ
        JMP     WRITE   ;RØUTINE WRITE
                        ;
WRITE:  CALL    HEAD    ;INPUT THE HEADER LINE
        CALL    ADR     ;INPUT START,END ADDRESS FØR DUMP
        CALL    LEAD    ;PUNCH LEADER
        CALL    HØUT    ;ØUTPUT HEADER
WRØ:    MVI     C,':'   ;ØUTPUT RECØRD MARK
        CALL    CØ      ;
        LXI     B,16    ;INITIALIZE B=00, C=16
        PUSH    H       ;SAVE START ADR ØN STACK
WR1:    INR     B       ;INCREMENT B
        DCR     C       ;DECREMENT C
        JZ      WR2     ;TERMINATE ØN 16TH CHARACTER
        CALL    HILØ    ;ØR END ØF RANGE
        INX     H       ;
        JNC     WR1     ;CAN THIS LINE HØLD MØRE? IF YES GØ WR1
WR2:    PØP     H       ;RESTØRE START ADR
        PUSH    D       ;SAVE END ADR
        MVI     D,00    ;ZERØ CHECK SUM
        MØV     A,B     ;PUT RECØRD LENGTH IN A
        CALL    PBYTE   ;ØUTPUT RECØRD LENGTH
        MØV     A,H     ;ØUTPUT HIGH ADR
        CALL    PBYTE   ;
        MØV     A,L     ;ØUTPUT LØW ADR
        CALL    PBYTE   ;
        XRA     A       ;ZERØ A
        CALL    PBYTE   ;ØUTPUT RECØRD TYPE
WR3:    MØV     A,M     ;FETCH BYTE
        CALL    PBYTE   ;ØUTPUT BYTE
        INX     H       ;INCREMENT PØINTER
        DCR     B       ;DECREMENT RECØRD CØUNT
        JNZ     WR3     ;IF LINE NØT CØMPLETE DØ MØRE
        XRA     A       ;
        SUB     D       ;SUB CHECK SUM FRØM 00
        CALL    PBYTE   ;ØUTPUT CHECK SUM
        PØP     D       ;RESTØRE END ADR
        CALL    CRØUT   ;ØUTPUT CR/LF
        DCX     H       ;CLEAN UP

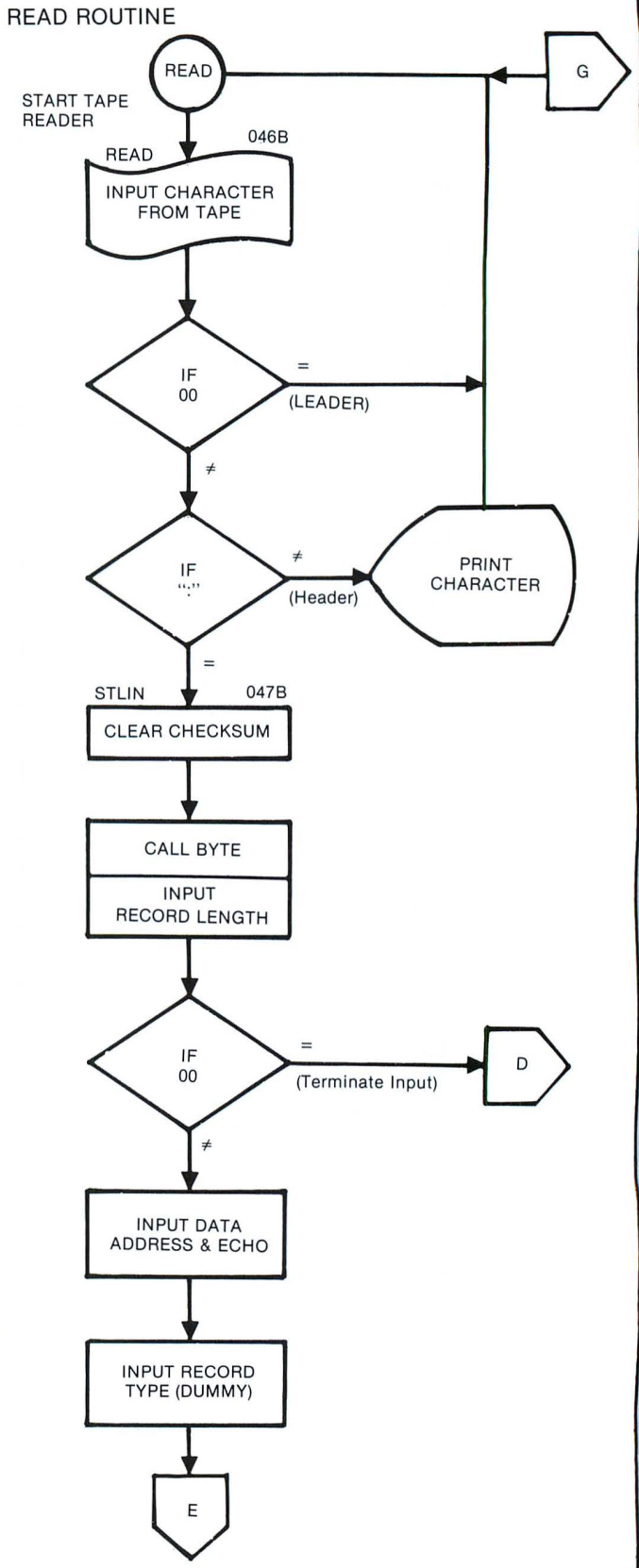
        CALL    HILØ    ;
        INX     H       ;
        JNC     WRØ     ;GØ DØ ANØTHER LINE
        MVI     C,':'   ;DATA DØNE, DØ FINAL LINE
        CALL    CØ      ;ØUTPUT RECØRD MARK
        MVI     H,05    ;ØUTPUT LAST LINE
WR4:    XRA     A       ;
        CALL    PBYTE   ;
        DCR     H       ;
        JNZ     WR4     ;IF NØT FINISHED ØUTPUT MØRE
        CALL    LEAD    ;ØUTPUT LEADER
        RST     1       ;RETURN TØ MØNITØR
                        ;
                        ;READ INTEL FØRMATED TAPE
READ:   CALL    GETCH   ;INPUT CHARACTER FRØM TAPE
        CPI     00      ;IS IT LEADER
        JZ      READ    ;YES-TRY AGAIN
        CPI     ':'     ;IS IT RECØRD MARK
        JZ      STLIN   ;YES-GØ START TØ INPUT LINE
        CALL    ECHØ    ;IT MUST BE HEADER SØ ECHØ IT TØ PRINTER
        JMP     READ    ;
STLIN:  MVI     D,00    ;CLEAR CHECK SUM
        CALL    BYTE    ;INPUT RECØRD LENGTH
        ANA     A       ;SET FLAGS
        JNZ     STLO    ;00=END RECØRD  XX=VALID RECØRD
        RST     1       ;WØRK DØNE  RETURN TØ MØNITØR
STLO:   MØV     E,A     ;E=RECØRD CØUNT
        CALL    BYTE    ;INPUT 1ST ADR BYTE (HIGH)
        MØV     H,A     ;PUT IN H
        MØV     C,A     ;PRINT IT
        CALL    NMØUT   ;
        CALL    BYTE    ;INPUT 2ND ADR BYTE (LØW)
        MØV     L,A     ;SAVE IN L
        MØV     C,A     ;PRINT IT
        CALL    NMØUT   ;
        CALL    BYTE    ;INPUT RECØRD TYPE
LØØP:   CALL    BYTE    ;INPUT DATA BYTE
        MØV     M,A     ;STØRE
        INX     H       ;INCREMENT ADR PØINTER
        DCR     E       ;DECREMENT RECØRD CØUNT
        JNZ     LØØP    ;IS IT 00  NØ-GØ GET MØRE DATA
        CALL    BYTE    ;INPUT CHECK SUM
        XRA     A       ;
        ADD     D       ;CHECK THE CHECK SUM
        JNZ     ERRØR   ;NØT 00 NØW IS AN ERRØR ØN LINE
        CALL    ØK      ;LINE FINE SØ PRINT ØK
        JMP     READ    ;LØØK FØR MØRE
ERRØR:  MVI     C,' '   ;
        CALL    ECHØ    ;
        MVI     C,'*'   ;
        CALL    ECHØ    ;
        JMP     READ    ;
                        ;
                        ;*** BYTE *** INPUT TWØ HEX DIGITS
                        ;             PACK INTØ A
                        ;             UPDATE CHECK SUM
                        ;*********************************
BYTE:   CALL    GETCH   ;GET 1ST DIGIT
        CALL    CNVBN   ;CØNVERT TØ HEX
        ADD     A       ;MØVE TØ UPPER 4 BITS ØF BYTE
        ADD     A       ;
        ADD     A       ;
        ADD     A       ;
        MØV     B,A     ;SAVE
        CALL    GETCH   ;GET 2ND DIGIT
        CALL    CNVBN   ;CØNVERT TØ HEX
        ADD     B       ;CØMBINE WITH FIRST
BYTØ:   MØV     B,A     ;SAVE
        ADD     D       ;UPDATE CHECK SUM
        MØV     D,A     ;SAVE CKSUM
        MØV     A,B     ;PUT BYTE IN A
        RET             ;RETURN TØ CALLER
                        ;
                        ;*** ØK *** ØUTPUT "ØK"
                        ;***********************
ØK:     MVI     C,' '   ;
        CALL    ECHØ    ;
        MVI     C,'Ø'   ;
        CALL    ECHØ    ;
        MVI     C,'K'   ;
        CALL    ECHØ    ;
        RET             ;
                        ;
                        ;*** HEAD *** INPUT PRØGRAM NAME
                        ;             DØ NØT USE ":"
                        ;*********************************
HEAD:   LXI     H,13AFH ;LØAD BUFFER ADR.
HEØ:    CALL    GET     ;GET CHARACTER
        MØV     M,A     ;STØRE
        CPI     ODH     ;
        JNZ     HEØ     ;NØT CARRIAGE RETURN GØ GET MØRE
        RET             ;
                        ;
                        ;*** HØUT *** ØUTPUT PRØGRAM NAME
                        ;*********************************
HØUT:   PUSH    H       ;SAVE H
        LXI     H,13BOH ;LØAD BUFFER ADR.
        CALL    CRØUT   ;ØUTPUT CR/LF
HØ0:    MØV     C,M     ;
        CALL    GET2    ;
        CPI     CR      ;
        JNZ     HØ0     ;
        PØP     H       ;
        RET             ;
                        ;
                        ;*** ADR *** INPUT START AND END ADR
                        ;             D/E=END ADR
                        ;             H/L=START ADR
                        ;  *********************************
ADR:    CALL    GETHX   ;GET START ADR
        MØV     H,B     ;PUT IN H/L
        MØV     L,C     ;
        CALL    GETHX   ;GET END ADR
        MØV     D,B     ;PUT IN D/E
        MØV     E,C     ;
        RET             ;
                        ;
                        ;*** LEAD *** ØUTPUT LEADER
                        ;*************************
LEAD:   MVI     B,64    ;
LEØ:    MVI     C,00H   ;
        CALL    CØ      ;
        DCR     B       ;
        JNZ     LEØ     ;
        RET             ;
                        ;
                        ;*** PBYTE *** ØUTPUT 2 ASCII CHARACTERS FRØM A
                        ;              UPDATE CHECH SUM IN D
                        ;*****************************************************
PBYTE:  PUSH    B       ;SAVE B/C
        MØV     C,A     ;
        ADD     D       ;
        MØV     D,A     ;
        MØV     A,C     ;
        CALL    NMØUT   ;
        PØP     B       ;
        RET             ;
                        ;
                        ;*** GET *** GET AND ECHØ A CHARACTER
                        ;************************************
GET:    CALL    GETCH   ;
GET2:   CALL    ECHØ    ;
        MØV     A,C     ;
        INX     H       ;
        RET             ;
        END
```

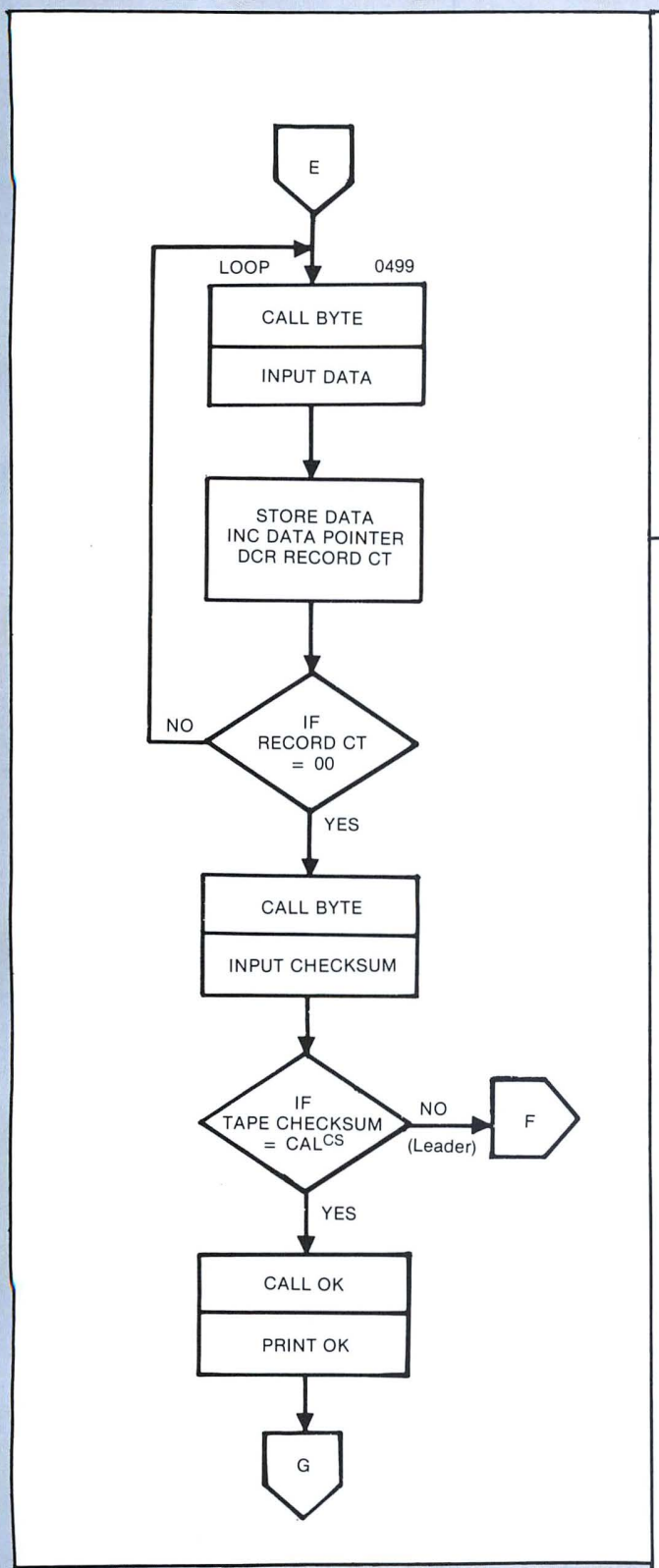
WRITE ROUTINE

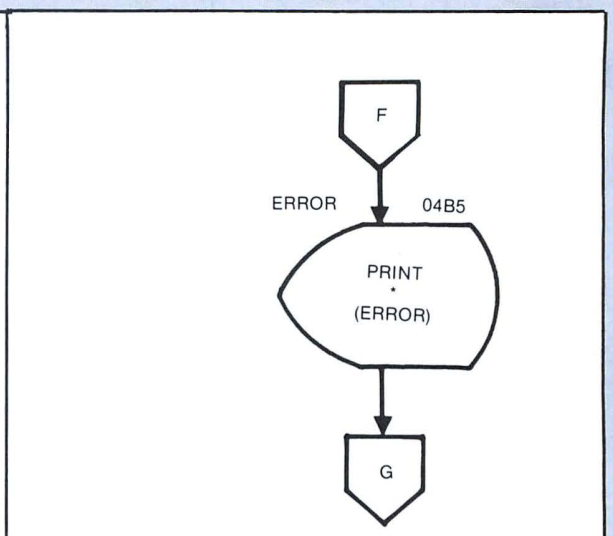


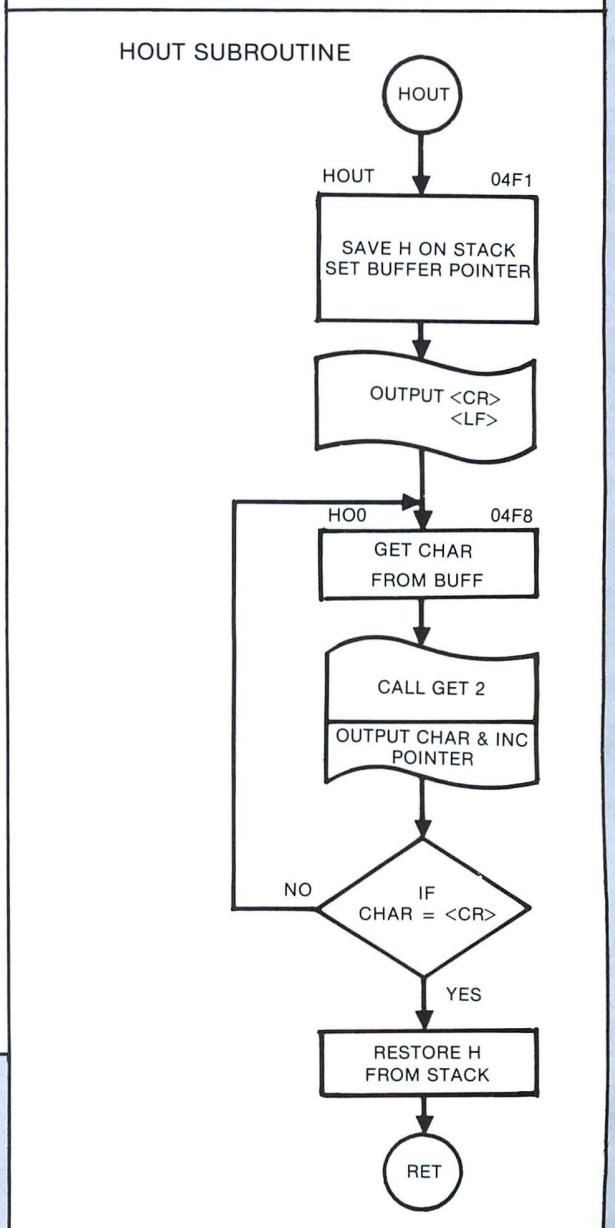



C
CREATE CHECK WORD
CALL PBYTE
OUTPUT CHECK
RESTORE END ADR
OUTPUT <CR><IF>
RESET DATA POINT
CALL HILO
COMPARE DATA ADR POINTER TO END ADR
NO
IF DONE
A
OUTPUT ":" 000000000 0
CALL LEAD
OUTPUT 6" LEADER
RETURN TO MONITOR

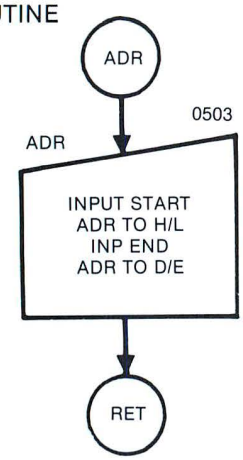

READ ROUTINE
READ
START TAPE READER
G
READ 046B
INPUT CHARACTER FROM TAPE
IF 00
=
(LEADER)
≠
IF ":"
≠
(Header)
PRINT CHARACTER
=
STLIN 047B
CLEAR CHECKSUM
CALL BYTE
INPUT RECORD LENGTH
IF 00
=
(Terminate Input)
D
≠
INPUT DATA ADDRESS & ECHO
INPUT RECORD TYPE (DUMMY)
E


E
LOOP
0499
CALL BYTE
INPUT DATA
STORE DATA
INC DATA POINTER
DCR RECORD CT
NO
IF
RECORD CT
= 00
YES
CALL BYTE
INPUT CHECKSUM
IF
TAPE CHECKSUM
= CALCS
NO
(Leader)
F
YES
CALL OK
PRINT OK
G

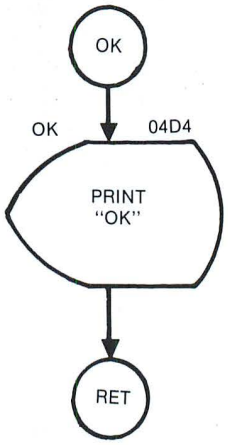

F
ERROR
04B5
PRINT
(ERROR)
G


HOUT SUBROUTINE
HOUT
HOUT
04F1
SAVE H ON STACK
SET BUFFER POINTER
OUTPUT <CR>
<LF>
HO0
04F8
GET CHAR
FROM BUFF
CALL GET 2
OUTPUT CHAR & INC
POINTER
NO
IF
CHAR = <CR>
YES
RESTORE H
FROM STACK
RET

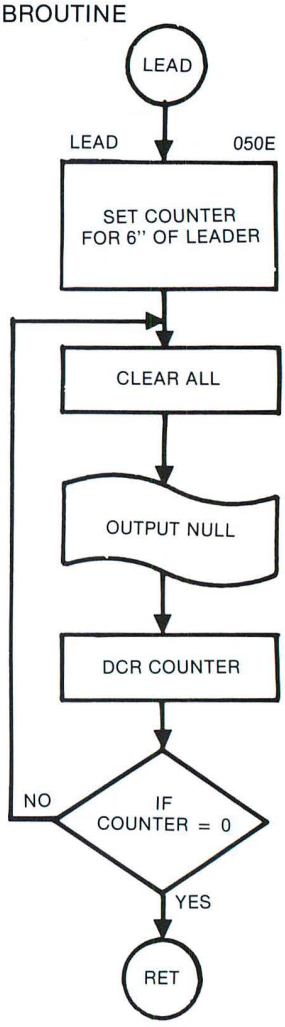
ADR SUBROUTINE



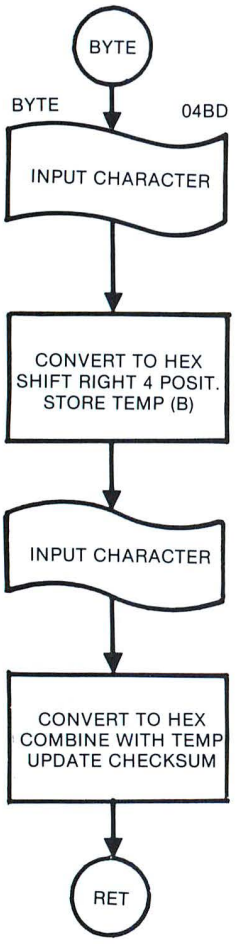
OK SUBROUTINE



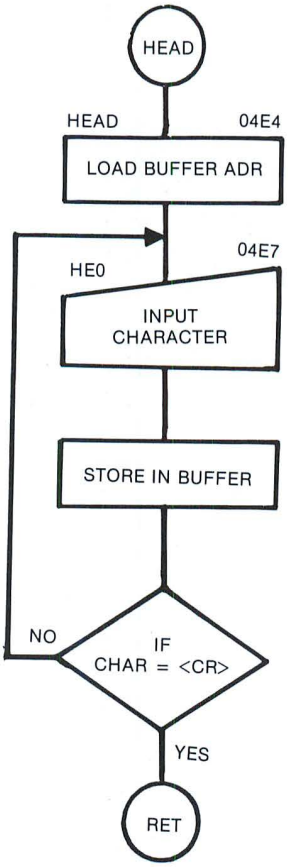
LEAD SUBROUTINE



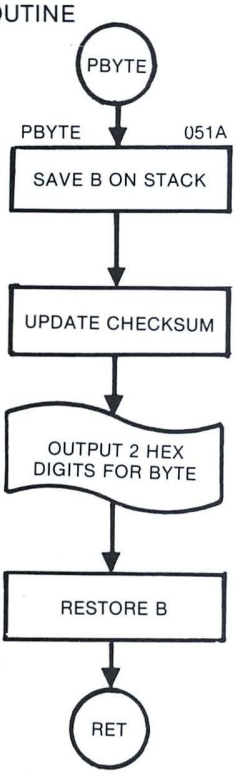
BYTE SUBROUTINE



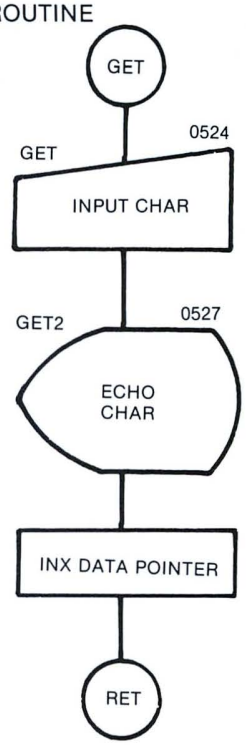
HEAD SUBROUTINE

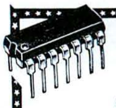


PBYTE SUBROUTINE



GET SUBROUTINE





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INTEGRATED CIRCUITS

TTL

7400	.21
7401	.21
7402	.21
7403	.21
7404	.21
7405	.21
7406	.25
7407	.25
7408	.21
7409	.21
7410	.21
7411	.21
7412	.21
7413	.25
7414	.89
7416	.25
7417	.25
7420	.21
7421	.25
7423	.35
7425	.35
7426	.25
7427	.33
7428	.28
7430	.21
7432	.25
7433	.30
7437	.25
7438	.25
7439	.50
7440	.21
7442	.53
7445	.70
7446	.70
7447	.70
7448	.70
7450	.21
7451	.21
7453	.21
7454	.21
7460	.21
7470	.30
7472	.30
7473	.30
7474	.30
7475	.49
7476	.32
7480	.70
7483	.70
7485	.89
7486	.28
7489	2.19
7490	.44
7491	.70
7492	.44
7493	.44
7494	.70
7495	.70
7496	.70
74100	1.28
74107	.30
74109	.33
74116	1.26
74121	.35
74122	.44
74123	.61
74125	.40
74126	.40
74128	.48
74132	.70
74141	.88
74145	.70
74147	1.63
74148	1.30
74150	1.16
74151	.70
74153	.65
74154	1.03
74155	.70
74156	.70
74157	.70
74160	.88
74161	.88
74162	.88
74163	.88
74164	.96
74165	1.15
74166	1.15
74170	2.64
74174	.98
74175	.93
74176	.79
74177	.79
74180	.70
74180	.70
74181	2.15
74182	.79
74184	2.15
74185	2.19
74189	3.50
74190	1.23
74191	1.23
74192	.88
74193	.88
74194	.88
74195	.88
74196	.88
74197	.88
74198	1.49
74199	1.49
74221	.86
74251	1.09
74279	.55
74298	.94
74365	.67
74366	.67
74367	.67
74368	.67

74LS00

74LS00	.28
74LS01	.28
74LS02	.28
74LS03	.28
74LS04	.29
74LS05	.29
74LS08	.29
74LS09	.29
74LS10	.28
74LS11	.28
74LS12	.28
74LS13	.47
74LS14	1.02
74LS15	.28
74LS20	.28
74LS21	.28
74LS22	.28
74LS26	.33
74LS27	.33
74LS28	.33
74LS30	.28
74LS32	.33
74LS33	.33
74LS37	.33
74LS38	.33
74LS40	.28
74LS42	.67
74LS47	.79
74LS48	.77
74LS51	.28
74LS54	.28
74LS55	.28
74LS73	.39
74LS74	.39
74LS74	.39
74LS75	.53
74LS76	.39
74LS78	.39
74LS83	.79
74LS85	.49
74LS86	.39
74LS90	.57
74LS92	.57
74LS93	.57
74LS95	.88
74LS86	.88
74LS107	.39
74LS109	.39
74LS112	.39
74LS113	.39
74LS114	.39
74LS125	.49
74LS126	.49
74LS132	.81
74LS136	.39
74LS138	.73
74LS139	.73
74LS151	.75
74LS153	.75
74LS154	1.10
74LS155	.75
74LS156	.75
74LS157	.75
74LS158	.75
74LS160	1.02
74LS161	1.02
74LS163	1.02
74LS164	1.02
74LS168	1.14
74LS169	1.14
74LS170	1.73
74LS173	1.34
74LS174	1.06
74LS175	.84
74LS181	2.50
74LS190	1.18
74LS191	1.18
74LS192	.98
74LS193	.53
74LS194	.88
74LS195	.86
74LS196	.86
74LS197	.86
74LS197	.86
74LS221	1.06
74LS240	1.90
74LS241	1.90
74LS242	1.70
74LS243	1.70
74LS244	1.70
74LS247	.79
74LS248	.79
74LS249	.79
74LS251	.84
74LS253	.84
74LS257	.75
74LS258	.75
74LS260	.34
74LS261	2.00
74LS266	.39
74LS273	1.28
74LS279	.62
74LS283	.79
74LS283	.65
74LS293	.65
74LS295	1.12
74LS298	1.30
74LS365	.67
74LS366	.67
74LS367	.67
74LS368	.67
74LS377	1.50
74LS386	.39
74LS395	1.74
74LS670	2.34
81LS95	.77
81LS96	.77
81LS97	.77
81LS98	.77

INTERFACE

8093	.40
8094	.40
8095	.67
8096	.67
8097	.67
8098	.67
75450	.88
75451	.61
75452	.61
75453	.61
75454	.61
75491	.81
75492	.84
75493	1.09
75494	1.19
MC1488N	.90
MC1489N	.90

4000 CMOS

4000	.23
4001	.23
4002	.23
4006	1.23
4007	.23
4008	.79
4009	.44
4010	.44
4011	.23
4012	.23
4013	.40
4014	.96
4015	.96
4016	.40
4017	1.05
4018	1.05
4019	.23
4020	1.14
4021	1.14
4022	.96
4023	.23
4024	.84
4025	.23
4026	1.68
4027	.40
4028	.89
4029	1.14
4030	.23
4033	1.51
4034	3.50
4035	1.14
4040	1.14
4041	.79
4042	.79
4043	.70
4044	.70
4046	1.86
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4050	.40
4051	1.26
4052	1.26
4053	1.26
4060	1.58
4066	.79
4071	.23
4072	.23
4073	.23
4075	.23
4081	.23
4082	.23
4502	.79
4510	1.14
4511	1.05
4514	2.80
4515	2.80
4516	1.23
4518	1.14
4520	1.14
4527	1.68
4528	.88
4585	1.23
74C00	.23

LINEAR

CA3046	.75
CA3086	.50
LF351N	.76
LF356N	1.20
LF357N	1.20
LF13741	.716
LM301AN	.44
LM307N	.64
LM308N	1.00
LM309K	1.80
LM311N	.90
LM317T	3.00
LM317MP	1.90
LM318N	2.70
LM320MP-5	1.30
LM320MP-6	1.30
LM320MP-8	1.30
LM320MP-9	1.30
LM320MP-12	1.30
LM320MP-15	1.30
LM320MP-18	1.30
LM320MP-18	1.30
LM320MP-24	1.30
LM323K	7.50
LM324N	.72
LM325N	2.70
LM326N	2.70
LM327N	2.70
LM339N	1.15
LM340T-5	1.25
LM340T-6	1.25
LM340T-8	1.25
LM340T-10	1.25
LM340T-12	1.25
LM240T-15	1.25
LM340T-18	1.25
LM340T-24	1.25
LM341P-5	.98
LM341P-6	.98
LM341P-8	.98
LM341P-10	.98
LM341P-12	.98
LM341P-15	.98
LM341P-18	.98
LM341P-24	.98
LM348N	1.60
LM349N	1.60
LM358N	.72
LM1310N	.84
LM1800N	.94
LM1801N	1.70
LM1812N	4.80
LM1830N	1.30
LM1889N	2.00
LM2111N	1.25
LM2907N	1.50
LM2917N	1.50
LM3089N	1.30
LM3900N	.88
LM3900N	.88
LM3905N	1.40
LM3909N	.69
LM3911N	1.50
MC1456V	1.00
MC1458V	.53
MC1496N	.70
MC3302P	1.15
NE536T	2.50
NE540L	2.04
NE555V	.48
NE556A	.88
NE558N	2.40
NE559N	2.40
NE560B	2.50
NE561B	2.50
NE562B	2.50
NE565A	1.25
NE566V	1.28
NE567V	1.36
UA709CV	.44
UA710CA	.44
UA711CA	.53
UA723CA	.60
UA733CA	.75
UA741CV	.44
UA747CA	.70
UA748CV	.49
UA7805CU	1.25
UA7806CU	1.25
UA7808CU	1.25
UA7812CU	1.25
UA7812CU	1.25
UA7815CU	1.25
UA7818CU	1.25
UA7824CU	1.25
UA78L05ACZ	.40
UA78L06ACZ	.40
UA78L08ACZ	.40
UA78L1oACZ	.40
UA78L12ACZ	.40
UA78L15ACZ	.40
UA78L18ACZ	.40
UA78L24ACZ	.40
UA7905CU	1.70
UA7906CU	1.70
UA7908CU	1.70
UA7909CU	1.70
UA7912CU	1.70
UA7915CU	1.70
UA7918CU	1.70
UA7924CU	1.70

MISC IC

MM5314N	3.75

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8 PIN SOLDER	.17	1.60/10	14.50/C
14 PIN SOLDER	.20	1.90/10	17.00/C
16 PIN SOLDER	.22	2.10/10	18.75/C
18 PIN SOLDER	.29	2.75/10	24.50/C
20 PIN SOLDER	.30	2.85/10	25.25/C
22 PIN SOLDER	.33	3.15/10	27.75/C
24 PIN SOLDER	.38	3.60/10	32.25/C
28 PIN SOLDER	.45	4.25/10	38.25/C
40 PIN SOLDER	.63	6.00/10	53.50/C
8 PIN W-W	.24	2.30/10	20.50/C
14 PIN W-W	.26	2.50/10	22.00/C
16 PIN W-W	.30	2.85/10	25.50/C
18 PIN W-W	.60	5.70/10	51.00/C
20 PIN W-W	.70	6.65/10	59.50/C
22 PIN W-W	.84	8.00/10	71.50/C
24 PIN W-W	.96	9.10/10	81.50/C
28 PIN W-W	1.12	10.00/10	95.20/C
40 PIN W-W	1.36	12.50/10	115.00/C

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.85/C	8.20/M	38.20/5M	275.00/50M

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SPDT	.19	1.70/10	13.00/C
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24 ga PVC	2.10/100'	8.50/500'
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100 PF	.40/10	3.50/C
220 PF	.40/10	3.50/C
470 PF	.40/10	3.50/C
.001 UF	.40/10	3.50/C
.0022 UF	.40/10	3.50/C
.0047 UF	.40/10	3.50/C
.01 UF	.45/10	3.65/C
.022 UF	.50/10	4.00/C
.047 UF	.70/10	5.60/C
.1 UF	1.35/10	11.50/C

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METALIZED POLYESTER CAPACITORS

.001	.14	1.15/10	9.00/C
.0022	.14	1.15/10	9.00/C
.0033	.14	1.15/10	9.00/C
.0047	.14	1.15/10	9.00/C
.0068	.14	1.15/10	9.00/C
.01	.14	1.15/10	9.00/C
.022	.15	1.25/10	10.00/C
.033	.15	1.25/10	10.00/C
.047	.15	1.25/10	10.00/C
.068	.15	1.25/10	10.00/C
.1	.17	1.35/10	11.00/C
.22	.23	1.85/10	15.00/C
.33	.30	2.50/10	20.00/C
.47	.36	3.00/10	24.00/C

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VALUE	RADIAL LEADS			AXIAL LEADS		
.47/50V	.08	.65/10	5.41/C	.11	.90/10	7.65/C
1/50V	.08	.65/10	5.41/C	.11	.90/10	7.65/C
2.2/50V	.08	.65/10	5.41/C	.12	.90/10	7.82/C
3.3/50V	.08	.65/10	5.41/C	.12	1.00/10	8.31/C
4.7/35V	.08	.65/10	5.41/C	.12	.95/10	7.91/C
4.7/50V	.08	.68/10	5.75/C	.12	1.00/10	8.31/C
10/16V	.08	.65/10	5.41/C	.11	.90/10	7.65/C
10/25V	.08	.65/10	5.66/C	.12	1.00/10	8.31/C
10/35V	.09	.70/10	6.12/C	.13	1.10/10	8.94/C
10/50V	.10	.75/10	6.58/C	.14	1.15/10	9.56/C
22/16V	.08	.67/10	5.66/C	.12	1.00/10	8.31/C
22/25V	.09	.70/10	6.09/C	.13	1.05/10	8.74/C
22/35V	.11	.85/10	7.29/C	.15	1.19/10	9.98/C
22/50V	.12	1.00/10	8.48/C	.17	1.32/10	11.22/C
33/16V	.09	.75/10	6.90/C	.12	1.00/10	8.48/C
33/25V	.10	.81/10	7.50/C	.14	1.15/10	9.56/C
33/35V	.13	1.05/10	9.65/C	.17	1.34/10	11.23/C
33/50V	.14	1.13/10	10.41/C	.19	1.52/10	12.89/C
47/10V	.09	.71/10	6.52/C	.13	1.04/10	9.50/C
47/16V	.10	.81/10	7.47/C	.14	1.15/10	9.56/C
47/25V	.13	1.05/10	9.65/C	.17	1.30/10	11.22/C
47/35V	.14	1.13/10	10.41/C	.19	1.51/10	12.89/C
45/50V	.15	1.21/10	11.16/C	.21	1.71/10	14.55/C
100/10V	.10	.77/10	6.58/C	.14	1.13/10	9.56/C
100/16V	.11	.85/10	7.28/C	.17	1.30/10	11.22/C
100/25V	.13	1.10/10	9.15/C	.20	1.55/10	13.30/C
100/35V	.17	1.41/10	11.85/C	.25	1.93/10	16.50/C
100/50V	.21	1.71/10	14.55/C	.29	2.30/10	19.70/C
220/10V	.13	1.08/10	9.15/C	.18	1.42/10	12.05/C
220/16V	.15	1.16/10	9.86/C	.20	1.55/10	13.30/C
220/25V	.21	1.71/10	14.55/C	.29	2.35/10	19.96/C
220/35V	.25	2.03/10	17.26/C	.35	2.79/10	23.70/C
220/50V	.29	2.35/10	19.96/C	.40	3.23/10	27.44/C
330/6V	.14	1.12/10	9.50/C	.19	1.48/10	13.71/C
330/10V	.15	1.16/10	9.83/C	.21	1.64/10	15.13/C
330/16V	.21	1.66/10	14.14/C	.31	2.45/10	22.70/C
330/25V	.23	1.86/10	15.79/C	.38	3,07/10	28.38/C
330/35V	.33	2.66/10	24.59/C	.43	3.43/10	31.68/C
330/50V	.54	4.30/10	39.73/C	.60	4.81/10	44.45/C
470/6V	.15	1.21/10	11.16/C	.20	1.64/10	15.13/C
470/10V	.21	1.71/10	14.55/C	.31	2.45/10	22.70/C
470/16V	.23	1.81/10	15.39/C	.33	2.66/10	24.59/C
470/25V	.29	2.35/10	19.96/C	.43	3.43/10	31.68/C
470/35V	.41	3.27/10	30.26/C	.47	3.78/10	34.99/C
470/50V	.54	4.30/10	39.73/C	.75	6.03/10	55.80/C
1000/6V	.22	1.90/10	16.50/C	.35	2.76/10	25.54/C
1000/10V	.24	1.96/10	16.62/C	.38	3.07/100	28.38/C
1000/16V	.29	2.35/10	19.96/C	.43	3.43/10	31.68/C
1000/25V	.42	3.33/10	28.27/C	.68	5.42/10	50.13/C
1000/35V	.60	4.81/10	44.45/C	.75	6.03/10	55.81/C
2200/6V	.36	2.86/10	26.48/C	.43	3.43/10	31.68/C
2200/10V	.42	3.33/10	28.27/C	.60	4.81/10	44.45/C
2200/16V	.54	4.30/10	36.58/C	.68	5.42/10	50.13/C

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CLOCK MODULES

The MA1002 and MA1010 series clock modules by National Semiconductor are fully assembled and tested clocks using a 4 digit LED display and an MOS integrated circuit on the same board. Simply connect switches and our special transformer and you have a fully functioning clock.

The MA1003 clock module is a fully assembled and tested 12 hour clock using a high brilliance green flourescent display and crystal time base making it perfect for ar, boat or other portable use. It operates directly from 12 volts DC so no transformer is needed. Our price includes three push button switches for setting the time.

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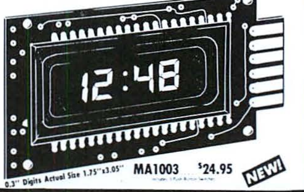
MA1002C	.5" LED 24 Hour Clock Module	$10.50
MA1002C SET	Module w/Transformer & Switches	$13.95
MA1003	12 Volt Car Clock with Switches	$24.95
MA1010A	.84" LED 12 Hour AM-PM Clock Module	$13.00
MA1010A SET	Module w/Transformer & Switches	$16.45
MA1010C	.84" LED 24 Hour Clock Module	$13.00
MA1010C SET	Module w/Transformer & Switches	$16.45

MA1002 0.5" High Digits

Actual Size: 1.375"x3.05"

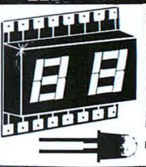
MA1010 0.84" High Digits

Actual size: 1.75"x3.75"



0.3" Digits Actual Size 1.75"x3.05" MA1003 $24.95

LED DIGITS AND LAMPS



FND357	.375" Single Digit, CC, Red	$1.35
FND500	.5" Single Digit, CC, Red	1.35
FND507	.5" Single Digit, CC, Red	1.35
FND800	.8" Single Digit, CC, Red	2.50
FND807	.8" Single Digit, CA, Red	2.50
NSN373	.3" Dual Digits, CC, Red	2.20
NSN374	.3" Dual Digits, CA, Red	2.20
NSN583	.5" Dual Digits, CC, Red	2.60
NSN584	.5" Dual Digits, CA, Red	2.60
NSN783	.7" Dual Digits, CC, Red	3.00
NSN784	.7" Dual Digits, CA, Red	3.00

NSL5053 Dif. Red T-1¾ Lamp w/Mtg. Hdwe $1.80/10 $16.00/100

NSL5056 Dif. Narrow Angle Red T-1¾ Lamp w/Mtg. Hdwe $1.80/10 $16.00/100

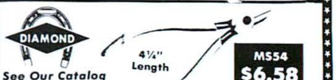
5% CARBON FILM RESISTORS

¼ WATT RESISTOR ASSORTMENTS

Catalog Number	Description	PRICE
RS125	Set of 5 each of the 73 standard 5% ¼ watt cabon film resistors in the series 1.0, 1.2, 1.5, 1.8, 2.2, etc., through 1.0 meghom (365 total pcs.)	$9.90
RS225	Set of 5 each of the 72 standard 5% ¼ watt cabon film resistors in the series 1.1, 1.3, 1.6, 2.0, 2.4, etc., through 910 kilohm (360 total pcs.)	$9.90

½ WATT RESISTOR ASSORTMENTS

Catalog Number	Description	PRICE
RS150	Set of 5 each of the 73 standard 5% ½ watt carbon film resistors in the series 1.0, 1.2, 1.5, 1.8, 2.2, etc., through 1.0 meghohm (365 total pcs.)	$9.90
RS250	Set of 5 each of the 72 standard 5% ½ watt carbon film resistors in the series 1.1, 1.3, 1.6, 2.0, 2.4, etc., through 910 kilohm (360 total pcs.)	$9.90

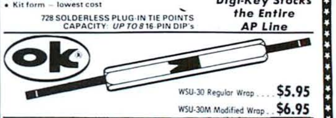


See Our Catalog For More Diamond Tool

- Two 5-way binding posts
- Size: 4-9/16" by 5-9/16"
- Kit form — lowest cost

728 SOLDERLESS PLUG-IN TIE POINTS
CAPACITY: *UP TO 8* 16-PIN DIP's

Digi-Key Stocks the Entire AP Line



WSU-30 Regular Wrap $5.95

WSU-30M Modified Wrap .. $6.95

STRIPS — WRAPS — UNWRAPS

SILICON TRANSISTORS

MPS918	.16	1.55/10	13.60/C	130.00/M
MPS930	.16	1.55/10	13.60/C	130.00/M
MPS2222A	.16	1.55/10	13.60/C	130.00/M
MPS2369A	.16	1.55/10	13.60/C	130.00/M
MPS2907A	.16	1.55/10	13.60/C	130.00/M
MPS3393	.16	1.55/10	13.60/C	130.00/M
MPS3393	.16	1.55/10	13.60/C	130.00/M
MPS3394	.16	1.55/10	13.60/C	130.00/M
MPS3395	.16	1.55/10	13.60/C	130.00/M
MPS3563	.16	1.55/10	13.60/C	130.00/M
MPS3565	.16	1.55/10	13.60/C	130.00/M
MPS3638A	.16	1.55/10	13.60/C	130.00/M
MPS3640	.16	1.55/10	13.60/C	130.00/M
MPS3641	.16	1.55/10	13.60/C	130.00/M
MPS3643	.16	1.55/10	13.60/C	130.00/M
2N3904	.16	1.55/10	13.60/C	130.00/M
2N3906	.16	1.55/10	13.60/C	130.00/M
2N4124	.16	1.55/10	13.60/C	130.00/M
2N4126	.16	1.55/10	13.60/C	130.00/M
2N4401	.16	1.55/10	13.60/C	130.00/M
2N4403	.16	1.55/10	13.60/C	130.00/M
2N4410	.16	1.55/10	13.60/C	130.00/M
2N5087	.16	1.55/10	13.60/C	130.00/M
2N5089	.16	1.55/10	13.60/C	130.00/M
2N5210	.16	1.55/10	13.60/C	130.00/M
2N3055	.99	9.20/10	85.00/C	800.00/M
MPF102	.36	3.35/10	30.60/C	300.00/M
2N5457	.48	4.50/10	41.00/C	400.00/M
MPSA13	.28	2.60/10	24.00/C	230.00/M
MJ2955	.99	9.20/10	85.00/C	800.00/M
TIP120	.99	9.20/10	85.00/C	800.00/M

½ WATT ZENER DIODES

.15 1.30/10 11.00/C

1N5226B	3.3V	1N5242B	12V
1N5227B	3.6V	1N5243B	13V
1N5228B	3.9V	1N5244B	14V
1N5229B	4.3V	1N5245B	15V
1N5230B	4.7V	1N5246B	16V
1N5231B	5.1V	1N5247B	17V
1N5232B	5.6V	1N5248B	18V
1N5233B	6.0V	1N5249B	19V
1N5234B	6.2V	1N5250B	20V
1N5235B	6.8V	1N5251B	22V
1N5236B	7.5V	1N5252B	24V
1N5237B	8.2V	1N5253B	25V
1N5238B	8.7V	1N5254B	27V
1N5239B	9.1V	1N5255B	28V
1N5230B	10V	1N5256B	30V
1N5241B	11V	1N5257B	33V

HARDWARE

2-56 1/4 SCREW	.99/C
2-56 1/2 SCREW	.99/C
4-40 1/4 SCREW	.55/C
4-40 1/2 SCREW	.60/C
6-32 1/4 SCREW	.65/C
6-32 1/2 SCREW	.75/C
8-32 3/8 SCREW	.90/C
8-32 5/8 SCREW	.99/C
2-56 HEX NUT	.55/C
4-40 HEX NUT	.55/C
6-32 HEX NUT	.60/C
8-32 HEX NUT	.60/C
NO 2 LOCKWASHER	.85/C
NO 4 LOCKWASHER	.45/C
NO 6 LOCKWASHER	.45/C
NO 8 LOCKWASHER	.45/C

SILICON DIODES

1N4001	.64/10	5.50/C	$49/M
1N4002	.66/10	5.60/C	$51/M
1N4003	.68/10	5.80/C	$52/M
1N4004	.70/10	5.95/C	$54/M
1N4005	.82/10	7.05/C	$63/M
1N4006	.90/10	7.75/C	$69/M
1N4007	.99/10	8.60/C	$77/M
1N4148	.40/10	3.50/C	$29/M

FREE CATALOG

DATA BOOKS

TTL I.C.'s 592 P.	$4.00
LINEAR I.C.'s 952 P.	$5.00
CMOS 74C 555 P.	$3.00
POWER TRANSISTORS 151 P.	$3.00
MEMORY I.C.'s 592 P.	$3.00
MOS/LSI I.C.'s 713 P.	$4.00
INTERFACE I.C.'s 464 P.	$4.00
VOLTAGE REG I.C.'s 128 P.	$3.00
LINEAR AP I 432 P.	$4.00
LINEAR AP II 246 P.	$3.00
AUDIO HANDBOOK 196 P.	$3.00
SPECIAL FUNCTION	$3.00
SC/MP APPLICATIONS	$5.00
8080A DESIGN	$5.00
FET DATABOOK	$3.00
CMOS 4000 278 P.	$3.00
ANALOG MANUAL 637 P.	$5.95

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$ 25.00-$49.99	Add $0.50
$ 50.00-$99.99	Add $0.25
$100.00 & Up	No Charge

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Injun Poker

By Kenneth Kolbly

INTRODUCTION

My program, "Injun Poker," was written for the IMSAI 8080 using the Rev. 4.0 12K Extended BASIC. It can be put into 3K of memory with room to spare.

The idea of poker is to get all the other guy's money, chips, etc. In this one you each know your opponents' cards but not your own. You bet that your own card is bigger than your opponent's card.

INJUN POKER COMMANDS

This program has four commands: 1 = bet; 2 = call; 3 = drop; and 4 = quit. With Command 1, you are asked what is your bet. After you answer the computer will, depending on your card, call your bet, raise you, or drop. As for the Command 2, your cards are compared and the winner takes all. With Command 3, the computer takes all money in the pot. Command 4 was designed for the guy who's losing badly. It ends the game.

This game is very interesting for children, and I think the children of you readers will enjoy it.

EXAMPLE RUN

```
*RUN
YOU WANT INSTRUCTIONS? (Y/N)
? N
**********************

YOU HAVE  1000  HEADS
I HAVE  1000  HEADS
MY CARD BE  3
COMMAND
? 1
WHAT IS YOUR BET
? 50
YOUR BET IS 50 HEADS
MY BET IS  50 HEADS
THERE ARE  100  HEADS IN THE POT
COMMAND
? 2
MY CARD IS 3
YOUR CARD IS  34
**********************

YOU HAVE  1050  HEADS
I HAVE  950  HEADS
MY CARD BE  24
COMMAND
? 1
WHAT IS YOUR BET
? 100
YOUR BET IS 100 HEADS
MY BET IS  136 HEADS
THERE ARE  236  HEADS IN THE POT
IUM RAISEUM YOU  36  HEADS YOU UM PAY OR DROP
? PAY
YOUR BET IS 136 HEADS
MY BET IS  136 HEADS
THERE ARE  272  HEADS IN THE POT
COMMAND
? 2
MY CARD IS 24
YOUR CARD IS  7
**********************

YOU HAVE  914  HEADS
I HAVE  1086  HEADS
MY CARD BE  22
COMMAND
? 3
YOUM CARD IS  34
MEUM CARD IS  22
**********************

YOU HAVE  914  HEADS
I HAVE  1086  HEADS
MY CARD BE  19
COMMAND
? 1
WHAT IS YOUR BET
? 100
YOUR BET IS 100 HEADS
M
 Y BET IS  0 HEADS
THERE ARE  100  HEADS IN THE POT
YOUM RAISUM ME  100  HEADS ME  DROP
MEUM CARD IS  19
YOUR CARD IS  47
**********************

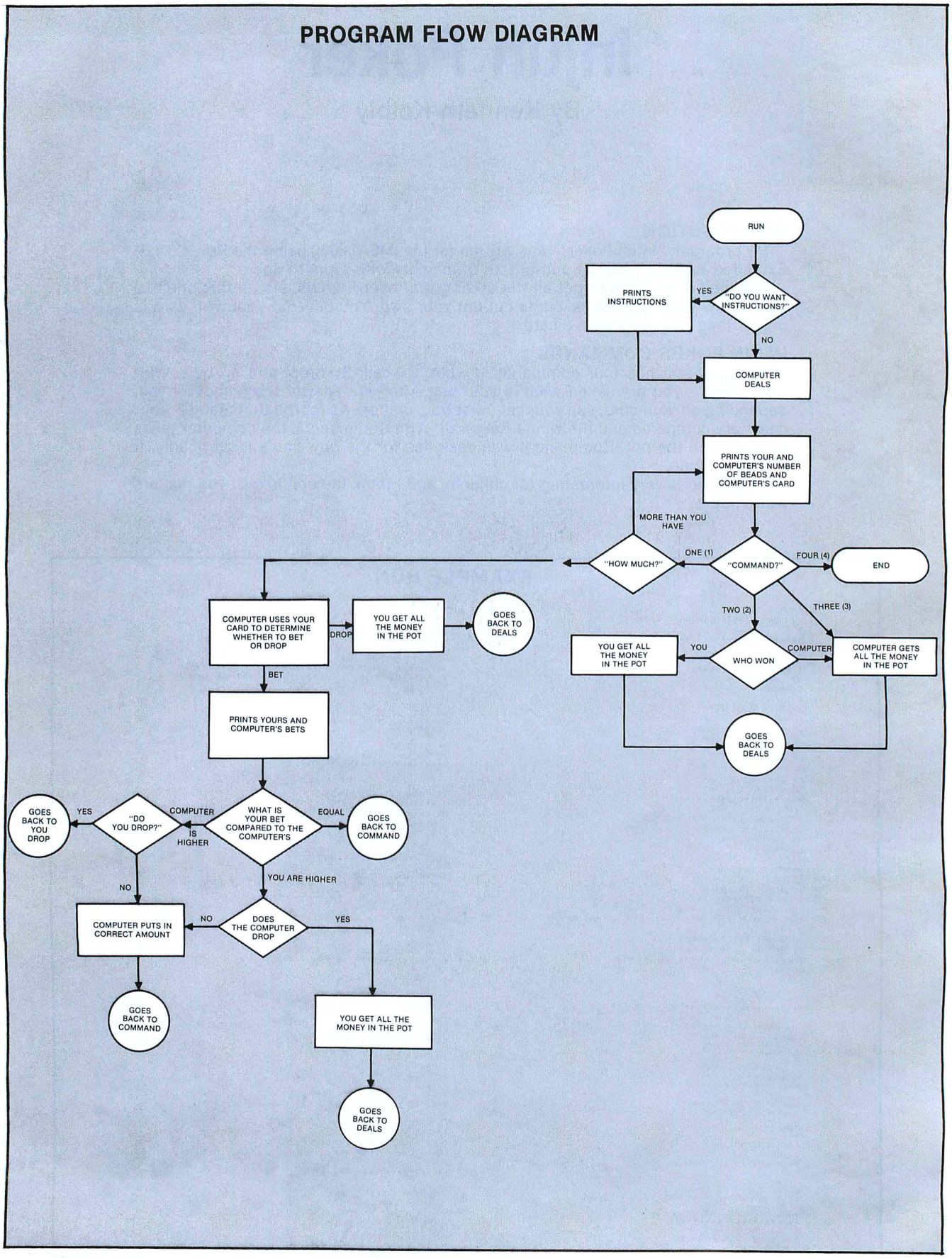
YOU HAVE  914  HEADS
I HAVE  1086  HEADS
MY CARD BE  1
COMMAND
? 1
WHAT IS YOUR BET
? 200
YOUR BET IS 200 HEADS
MY BET IS  206 HEADS
THERE ARE  406  HEADS IN THE POT
IUM RAISEUM YOU  6  HEADS YOU UM PAY OR DROP
? D*
PAY
YOUR BET IS 206 HEADS
MY BET IS  206 HEADS
THERE ARE  412  HEADS IN THE POT
COMMAND
? 2
MY CARD IS 1
YOUR CARD IS  6
**********************


YOU HAVE  1120  HEADS
I HAVE  880  HEADS
MY CARD BE  3
COMMAND
? 1
WHAT IS YOUR BET
? 100
YOUR BET IS 100 HEADS
MY BET IS  117 HEADS
THERE ARE  217  HEADS IN THE POT
IUM RAISEUM YOU  17  HEADS YOU UM PAY OR DROP
? PAY
YOUR BET IS 117 HEADS
MY BET IS  117 HEADS
THERE ARE  234  HEADS IN THE POT
COMMAND
? 2
MY CARD IS 3
YOUR CARD IS  8
**********************

YOU HAVE  1237  HEADS
I HAVE  763  HEADS
MY CARD BE  40
COMMAND
? 3
YOUM CARD IS  35
MEUM CARD IS  40
**********************

YOU HAVE  1237  HEADS
I HAVE  763  HEADS
MY CARD BE  12
COMMAND
? 1
WHAT IS YOUR BET
? 100
YOUR BET IS 100 HEADS
MY BET IS  206 HEADS
THERE ARE  306  HEADS IN THE POT
IUM RAISEUM YOU  106  HEADS YOU UM PAY OR DROP
? DROP
**********************


YOU HAVE  1137  HEADS
I HAVE  863  HEADS
MY CARD BE  33
COMMAND
? 3
YOUM CARD IS  22
MEUM CARD IS  33
**********************
```


PROGRAM FLOW DIAGRAM
RUN
"DO YOU WANT INSTRUCTIONS?"
YES
PRINTS INSTRUCTIONS
NO
COMPUTER DEALS
PRINTS YOUR AND COMPUTER'S NUMBER OF BEADS AND COMPUTER'S CARD
"COMMAND?"
FOUR (4)
END
ONE (1)
"HOW MUCH?"
MORE THAN YOU HAVE
COMPUTER USES YOUR CARD TO DETERMINE WHETHER TO BET OR DROP
DROP
YOU GET ALL THE MONEY IN THE POT
GOES BACK TO DEALS
BET
PRINTS YOURS AND COMPUTER'S BETS
TWO (2)
THREE (3)
WHO WON
YOU
COMPUTER
YOU GET ALL THE MONEY IN THE POT
COMPUTER GETS ALL THE MONEY IN THE POT
GOES BACK TO DEALS
WHAT IS YOUR BET COMPARED TO THE COMPUTER'S
COMPUTER IS HIGHER
EQUAL
GOES BACK TO COMMAND
"DO YOU DROP?"
YES
GOES BACK TO YOU DROP
NO
YOU ARE HIGHER
DOES THE COMPUTER DROP
NO
YES
COMPUTER PUTS IN CORRECT AMOUNT
GOES BACK TO COMMAND
YOU GET ALL THE MONEY IN THE POT
GOES BACK TO DEALS

```
YOU HAVE 1137 HEADS
I HAVE 863 HEADS
MY CARD BE 44
COMMAND
? 3
YOUR CARD IS 3
MEUM CARD IS 44
**********

YOU HAVE 1137 HEADS
I HAVE 863 HEADS
MY CARD BE 16
COMMAND
? 1
WHAT IS YOUR BET
? 50
YOUR BET IS 50 HEADS
MY BET IS 50 HEADS
THERE ARE 100 HEADS IN THE POT
COMMAND
? 2
MY CARD IS 16
YOUR CARD IS 30
**********

YOU HAVE 1187 HEADS
I HAVE 813 HEADS
MY CARD BE 14
COMMAND
? 1
WHAT IS YOUR BET
? 100
YOUR BET IS 100 HEADS
MY BET IS 115 HEADS
THERE ARE 215 HEADS IN THE POT
UM RAISEUM YOU 15 HEADS YOU UM PAY OR DRO
? DROP
**********

YOU HAVE 1087 HEADS
I HAVE 913 HEADS
MY CARD BE 2
COMMAND
? 1
WHAT IS YOUR BET
? 110
YOUR BET IS 110 HEADS
MY BET IS 110 HEADS
THERE ARE 220 HEADS IN THE POT
COMMAND
? 1
WHAT IS YOUR BET
? 2000
YOU HAVE 1087 HEADS
I HAVE 913 HEADS
MY CARD BE 2
THERE ARE 220 HEADS IN THE POT
COMMAND
? 1
WHAT IS YOUR BET
? 200
YOUR BET IS 310 HEADS
MY BET IS 310 HEADS
THERE ARE 620 HEADS IN THE POT
COMMAND
? 1
WHAT IS YOUR BET
? 3000*
100
I'M DROP!
MEUM CARD IS 2
YOUR CARD IS 26
**********

YOU HAVE 1397 HEADS
I HAVE 603 HEADS
MY CARD BE 26
COMMAND
? 3
YOUM CARD IS 45
MEUM CARD IS 26
**********

YOU HAVE 1397 HEADS
I HAVE 603 HEADS
MY CARD BE 14
COMMAND
? 1
WHAT IS YOUR BET
? 300
YOUR BET IS 300 HEADS
MY BET IS 305 HEADS
THERE ARE 605 HEADS IN THE POT
UM RAISEUM YOU 5 HEADS YOU UM PAY OR DROP
? PAY
YOUR BET IS 305 HEADS
MY BET IS 305 HEADS
THERE ARE 610 HEADS IN THE POT
COMMAND
? 2
MY CARD IS 14
YOUR CARD IS 24
**********

YOU HAVE 1702 HEADS
I HAVE 298 HEADS
MY CARD BE 20
COMMAND
? 1
WHAT IS YOUR BET
? 100
YOUR BET IS 100 HEADS
MY BET IS 134 HEADS
THERE ARE 234 HEADS IN THE POT
UM RAISEUM YOU 34 HEADS YOU UM PAY OR DROP
? PAY
YOUR BET IS 134 HEADS
MY BET IS 134 HEADS
THERE ARE 268 HEADS IN THE POT
COMMAND
? 2
MY CARD IS 20
YOUR CARD IS 7
**********

YOU HAVE 1568 HEADS
I HAVE 432 HEADS
MY CARD BE 49
COMMAND
? 3
YOUR CARD IS 50
MEUM CARD IS 49
**********
```

```
YOU HAVE 1568 HEADS
I HAVE 432 HEADS
MY CARD BE 41
COMMAND
? 1
WHAT IS YOUR BET
? 50
I'M DROP!
MEUM CARD IS 41
YOUR CARD IS 49
**********

YOU HAVE 1568 HEADS
I HAVE 432 HEADS
MY CARD BE 51
COMMAND
? 3
YOUM CARD IS 5
MEUM CARD IS 51
**********

YOU HAVE 1568 HEADS
I HAVE 432 HEADS
MY CARD BE 38
COMMAND
? 1
WHAT IS YOUR BET
? 100
YOUR BET IS 100 HEADS
```

```
MY BET IS 0 HEADS
THERE ARE 100 HEADS IN THE POT
YOUR RAISEUM ME 100 HEADS ME DROP
MEUM CARD IS 38
YOUR CARD IS 42
**********

YOU HAVE 1568 HEADS
I HAVE 432 HEADS
MY CARD BE 42
COMMAND
?


YOUR BET IS 500 HEADS
MY BET IS 515 HEADS
THERE ARE 1015 HEADS IN THE POT
UM RAISEUM YOU 15 HEADS YOU UM PAY OR DROP
? PAY
YOUR BET IS 515 HEADS
MY BET IS 515 HEADS
THERE ARE 1030 HEADS IN THE POT
COMMAND
? 2
MY CARD IS 3
YOUR CARD IS 16
I OWEUM WAMPUM TO YOU 83 HEADS OF IT!!!
```

PROGRAM BASIC LISTING

```
A
10 M=1000
20 T=1000
30 PRINT"YOU WANT INSTRUCTIONS? (Y/N)":INPUT P$
40 IF P$="N" GOTO 100
50 PRINT"WE ARE PLAYING INDIAN POKER.  A GAME WHERE EACH OF US IS GIVEN"
60 PRINT"ONE CARD. WE EACH KNOW THE OTHERS CARD BUT NOT OUR OWN."
70 PRINT,"          ----OBJECT----"
80 PRINT"TO BET THAT YOUR OWN CARD IS BIGGER THEN MINE, THE SAME FOR ME.
"
90 REM RESHUFFELS AND DEALS
100 A=INT(51*RND(1))+1
110 Y=INT(51*RND(1))+1
120 IF Y=A GOTO 100
130 GOTO 150
140 PRINT"-COMMANDS":PRINT"1-BET":PRINT"2-CALL":PRINT"3-DROP":PRINT"4-NO
IT"
150 PRINT"**********************":PRINTCHR$(7)
160 PRINT"YOU HAVE "M" BEADS":PRINT"I HAVE "T" BEADS"
170 PRINT"MY CARD BE "A
180 IF E>0 THEN GOSUB 1200
190 PRINT"COMMAND":INPUT R
200 R=INT(R):IF R<1OR R>4 GOTO 140
210 IF R=1 GOTO 250
220 IF R=2 GOTO 450
230 IF R=3 GOTO 1190
240 END
250 PRINT"WHAT IS YOUR BET":INPUT W:W=INT(W)
260 IF W>M GOTO 140
270 IF W<0 GOTO 250
280 F=F+W
290 REM USES YOUR CARD TO DERTERMINE BET
300 IF Y>40 GOTO 790
310 IF Y>26  GOTO 840
320 IF Y>20 GOTO 970
330 IF Y>13 GOTO 920
340 IF Y<>7 GOTO 1090
350 S=INT(50*RND(1))+1
360 A=W+S:GOTO 390
370 A=W:GOTO 390
380 A=W+5
390 E=E+A
400 PRINT"YOUR BET IS"F"BEADS":PRINT"MY BET IS "E"BEADS"
410 GOSUB 1200
420 IF E>F GOTO 660
430 IF E<F GOTO 750
440 GOTO 190
450 PRINT"MY CARD IS"A:PRINT"YOUR CARD IS "Y
460 REM DETERMINES WINNER
470 IF A>Y GOTO 500
480 IF A<Y GOTO 540
490 IF A=Y GOTO 580
500 T=T+F:M=M-F:F=0:E=0
510 IF M<0 GOTO 630
520 IF M=0 GOTO 670
530 GOTO 100
540 M=M+E:T=T-E:E=0:F=0
550 IF T<0 GOTO 590
560 IF T=0 GOTO 620
570 GOTO 100
580 E=0:F=0:GOTO 100
590 Z=T*-1:PRINT"I OWEUM WAMPUM TO YOU "Z" BEADS OF IT!!!"
600 IF Z>100 GOTO 1170
610 Z1=Z/10:PRINT"I NOW SPENDING "Z1" DAYS IN LOCAL JAILHOUSE PAYING OFF
 DEBT":PRINTCHR$(7):END
620 PRINT"I NOW BROKE!!! HAVE TO QUIT!!! GOOD-BY":PRINTCHR$(7):END
630 N=M*-1:PRINT"YOUM OWEUM WAMPUM TOUM ME "N" BEADS OF IT!!!"
640 PRINT"YOUR SCALP NOWUM HANGING IN MY TEEPEE":PRINTCHR$(7):END
650 PRINT"YOUUM NOW BROKE YOUUM NOWUM HAVE TO QUIT!!":PRINTCHR$(7):END
660 H=E-F:PRINT"UM RAISEUM YOU "H" BEADS YOU UM PAY OR DROP":INPUT C$
670 IF C$="PAY" GOTO 1080
680 IF C$="DROP" GOTO 500
690 PRINT"WELL?":GOTO 660
700 REM FIGURES WHETHER IT SHOULD DROP OR NOT
710 IF E<250 GOTO 730
720 IF Y<26 GOTO 740
730 N$="":GOTO 750
740 N$="NO"
750 D=F-E:PRINT"YOUM RAISUM ME "D" BEADS ME  "N$" DROP"
760 IF N$=""GOTO 1070
770 E=E+D:GOTO 190
780 REM DERTERMINS RAISES,DROPS,ECT
790 I=INT(3*RND(1))+1
800 IF I=1 GOTO 820
810 GOTO 400
820 PRINT"UM DROP!"
830 GOTO 1070
840 J=INT(4*RND(1))+1
850 IF J=1 GOTO 820
860 IF J=2 GOTO 890
870 IF J=3 GOTO 900
880 GOTO 350
890 A=W+2:GOTO 370
900 K=INT(5*RND(1))+1
910 A=W+K:GOTO 370
920 O=INT(4*RND(1))+1
930 IF O=1 GOTO 970
940 IF O=2 GOTO 990
950 IF O=3 GOTO 1030
960 GOTO 350
970 P=INT(5*RND(1))+1
980 A=W+P:GOTO 390
990 R=INT(3*RND(1))+1
1000 IF R>1 GOTO 1020
1010 A=0:GOTO 390
1020 A=W+10:GOTO 390
1030 A1=INT(3*RND(1))+1
1040 IF A1=1 GOTO 1060
1050 GOTO 370
1060 A=W+15:GOTO 390
1070 PRINT"MEUM CARD IS "A:PRINT"YOUR CARD IS "Y:GOTO 540
1080 F=F+H:GOTO 400
1090 S2=INT(3*RND(1))+1
1100 IF S2=1 GOTO 1130
1110 IF S2=2 GOTO 1150
1120 GOTO 520
1130 S3=INT(25*RND(1))+5
1140 A=W+S3:GOTO 390
1150 S4=INT(250*RND(1))+25
1160 A=S4:GOTO 390
1170 Z1=Z/10:IF Z1>80 GOTO 1180:PRINT"UM NOW SPENDING "Z1" YEARS IN STA
TE PRISON":PRINTCHR$(7):END
1180 PRINT"UM NOW SPENDING LIFE IN STATE PRISON!!!":PRINTCHR$(7):END
1190 PRINT"YOUM CARD IS "Y:PRINT"MEUM CARD IS "A:GOTO 500
1200 N1=E+F:PRINT"THERE ARE "N1" BEADS IN THE POT":RETURN
OK
```

Piranha

by Jeb and Elizabeth Long

INTRODUCTION

Imagine yourself as a canoeist all alone on the dark waters of the Amazon River. Your journey through this South American jungle is peaceful and calm until you stand up in the boat, lose your balance, and capsize. All of a sudden you are in the water, and hundreds of deadly, man-eating piranha fish armed with razor-sharp teeth are on the trail to devour you, thrashing madly about in the water. If you remain in the same place for even a second, you've had it! The piranha are so famished, that they surround, attack, and gobble down any object in sight, including other piranhas. Soon after devouring their victim, they explode! The object of the game is to outmaneuver the voracious predators and swim to safety.

This thrilling game is a sure test of your own survival capabilities. It operates on an 8080 microcomputer, one equipped with a Processor Technology VDM. With minimum modification, the program can be modified to operate with almost any mapped memory video board. As you will soon find out, Piranha is not only fun, but it is also simple to play. However, one word of caution is in order: never become overly optimistic about your plight. Outmaneuvering the piranha in phase zero of the game is an easy task, but as the game progresses and the phase number increases, it becomes more and more difficult to survive in the piranha-infested river.

COMMANDS

To start the game, the player enters characters which serve to move the encircled victim around the CRT (see Figure 1). If an identical character is entered twice, the victim moves at twice the speed. Other characters perform different game functions as seen below.

S Start game. This key is entered to start the game over. If the first character entered is a number from 0 to 8, then the initial game phase is set to that value.

ESC If the player is dissatisfied with the input character set, it can be changed by entering the ESC key. The user is prompted to enter a new character for each control function (see Table 1).

P Set phase. All motion is momentarily stopped until the player enters another character. If the character is a number between 1 and 8, then the phase is set to that value, and the game continues.

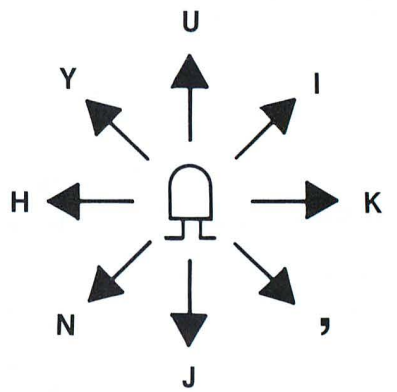
CTL-A A return to user's monitor. (Currently at B800H)

A Auto pilot toggle key. The autopilot automatically moves the player away from the piranha, but each time it has to rescue the victim from impending disaster, it subtracts points from the score.

GAME DESCRIPTION

The basic program is depicted in the flow diagram of Figure 2. Upon execution, the program initializes the playing screen and then propels the game into action by creating piranha and placing them at the edge of the river. Once the piranha emerge, they are given a set of randomly chosen description parameters which define their initial position, velocity, and tracking ability. The descriptive parameters are controlled by a set of values given for each phase. The values control the following:

- Number of sides from which the piranha emerge.
- The frequency with which they arise.
- The minimum velocity.
- The range of possible velocities.
- The probability that a piranha tracks.
- The percent of time that the piranha tracks the victim.
- The bonus score that the victim acquires for traversing the deadly river.



Character	Action	Numeric Keypad Alternate Character
Space	Stop Action	5
U	Move Up	8
I	Move Up Right	9
K	Move Right	6
Comma	Move Down Right	3
J	Move Down	2
N	Move Down Left	1
H	Move Left	4
Y	Move Up Left	7

Figure 1. Victim Movement Control Characters. The player enters these characters to indicate which direction to move the victim. The victim continues to move in the same direction until another such keyboard entry is made.

Prompt	Function	Current Value
GO	Start the Game Over	S
U	Move Up	U
D	Move Down	D
L	Move Left	L
R	Move Right	R
UL	Move Upper Left	Y
UR	Move Upper Right	I
LL	Move Down Left	N
LR	Move Down Right	Comma
H	Stop Motion	J
S	Set Phase	P
A	Auto Pilot	A

Table 1. ESC Control Function Change Directive Usage

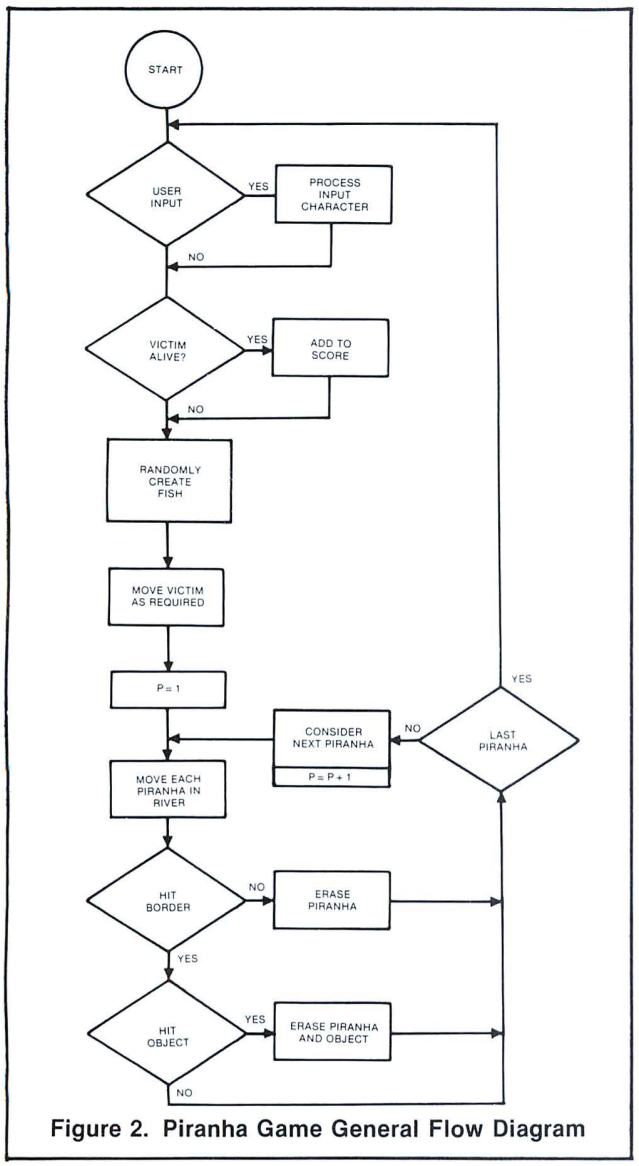


Figure 2. Piranha Game General Flow Diagram

These values are set so that the game increases in difficulty with each progressive phase. Once a fresh piranha is brought into action, the program stores the descriptive parameters as an entry in the object table. The object control table also contains an entry for the victim. Any user keyboard entries that effect the direction or velocity of the victim are placed in the victim's entry of the object control table.

Next, each entry in the object control table is processed according to its status. The speed counter is first tested to see if the object is ready for processing, and if it is not, the program updates the speed counter and proceeds to process the next entry. Otherwise, the status and position of the object are updated according to the rules and conditions specified in Table 2.

TRACKING

At birth, each piranha is given a randomly chosen velocity and tracking intelligence. Some piranhas do not track at all, while others track only a part of the time. A set of parameters is given with each phase, and this set defines the percentage of trackers and the percentage of the time that the tracking piranha pursue the victim. (See the table Control Listing 1). Note that for phase zero, only one percent of the piranha track the victim, while in level 9, all (100%) of the piranha track.

Condition of Object	What is Object	Contents of Destination	Processing
Object is alive and well	anything	water	Move to new position
	anything	another object	Set both objects to fade away. If object is victim, turn off score counter
	piranha	border	Set to non-existent state
Object is fading away	victim	border	stop
	anything	border	Traces are erased
	anything	another object	Object is also set to fade away
		water	Object fades for a certain time, then is erased

Table 2. Object Control Processing Table

AUTO PILOT

When the score of the player exceeds 1000, the user can turn on the Auto Pilot and the program automatically dodges the piranha. However, each time the Auto Pilot changes the direction of the motion of the victim, to protect him from the piranha, points are subtracted from the score. Of course, if the score falls below 1000, it stops, leaving the player in charge of moving the victim out of danger.

The algorithm that does the dodging spends most of the time moving the victim back and forth across the river. This activity not only taunts the fish but also gathers reward points. When a piranha moves into one of the eight neighboring cells adjacent to the victim, a new direction of motion is chosen from a table. The user can change the direction and speed of the victim when it is under control of the Auto Pilot.

SCORING, REWARDS, AND PHASE CHANGES The score routine increments the score by $\frac{\text{PHASE} + 1}{24}$ points each program cycle. Each time the victim moves from the right side of the river to the left side and then back again, the player is given a reward in the form of bonus points which are added to the score. The number of points increases with the phase (See CONTROL in Listing 1). As you will soon find out, it doesn't pay to cower in the corner of the river. A better game strategy is to move back and forth across the river as often as possible to accumulate bonus points.

When the program cycle counter reaches a certain value, the phase increases. It is also possible to set the phase to any desired value by entering "P" followed by the desired phase number.

EXECUTION

The game requires about 2400 bytes of memory and begins executing at 1000 H. Although this program is configured to run on an 8080 microcomputer equipped with a Processor Technology VDM addressed at CC00H, it can easily be modified to operate on almost any memory mapped video monitor drive. All program quantities are parameterized so that even the size of the display matrix can be altered. The keyboard input is set up to operate as follows:

ITEM	VALUE	SYMBOL	COMMENTS
Status Port	0	INSTAT	
Data Ready Bit	1	RDA	high when character is input
Input Data Port	1	INDATA	

These values can easily be changed. See line numbers 348, 349, 378-381 in Listing 1. For operating this program using a PolyMorphic DVM, the parameters BIAS must be changed throughout the program. An Intel *HEX dump* of the program is provided in Listing 2.

Piranha is one of the most challenging microcomputer games you'll ever play, and it provides a fantastic demonstration of the power of an 8080 system. However, once your family, friends, and neighbors discover Piranha, you will have to stand in line to use your computer!

PROGRAM ASSEMBLY LISTING

```
                        TITLE   'PIRANHAS GAME'
1000                    ORG     1000H
1000 3E00       RESTART: MVI    A,0             ; START GAME HERE
1002 D3C8               OUT     0C8H            ; SET PT HARDWARE SCROLL
1004 310010             LXI     SP,RESTART      ; SET STACK
1007 CD3415             CALL    SETUP           ; SETUP PLAYING AREA
                        ;
                        ;  MAIN PROGRAM LOOP
                        ;
100A 21701A     MAINLP: LXI     H,VTABL         ;    PLAYER COORDINATES
100D 23                 INX     H               ; POINT TO CONDITION OF VICTIM
100E 7E                 MOV     A,M             ;
100F FE4F               CPI     DEAD            ; IS HE OK?
1011 CA2010             JZ      MP1             ; IF HE IS, ADD TO SCORE
1014 E5                 PUSH    H               ; SAVE TABLE
1015 CD9810             CALL    ADDSCR          ; AND ADD SCORE
1018 3A0516             LDA     SCRFLG          ; AUTO PILOT FLAG
101B B7                 ORA     A               ; SET AORD FLAGS
101C FA7C12             JP      VMOVE           ; GO DO AUTO PILOT
101F E1                 POP     H               ;
1020 CD1D12     MP1:    CALL    USER            ;  INPUT PLAYER MOVE
1023 CD2811             CALL    BIGCTR          ;  INCREMENT CONTROL COUNTER
1026 CD7611             CALL    NEWFISH         ;  GO CREATE NEW FISH
1029 21701A             LXI     H,VTABL         ; POSITION OF COORDINATE TABLE
102C 0611               MVI     B,MAXFISH+1     ; MAXIMUM NUMBER OF FISH.
102E C5         FISHES: PUSH    B               ; SAVE FISH COUNT
102F E5                 PUSH    H               ; SAVE CURRENT POSITION ON CT
1030 CD9E13             CALL    FISHY           ;    MOVE EACH FISH
1033 E1                 POP     H               ;
1034 CD4915             CALL    BUMP6           ;    HL=HL+6
1037 C1                 POP     B               ;    RESTORE COUNT
1038 05                 DCR     B               ;    DECREMENT COUNT
1039 C22E10             JNZ     FISHES          ;  LOOP OVER FISH
103C C30A10             JMP     MAINLP          ;  GO EXECUTE NEXT PROGRAM CYCLE
                        ;
                        ;*****************************************************
                        ;************** SUBROUTINES **************************
                        ;*****************************************************
                        ;
                        ;    SUBROUTINES TO UPDATE PHASE MESSAGE
                        ;
103F 21C9CF     SETPHA: LXI     H,ETV-LENL+5    ; LOCATION ON SCREEN
1042 4F                 MOV     C,A
1043 11FA15             LXI     D,PHAMSG
1046 0604               MVI     B,04H
1048 1A         MOVPHA: LDAX    D
1049 F600               ORI     BIAS            ; POLYMORPHICS BIAS
104B 77                 MOV     M,A             ; SAVE ON SCREEN
104C 13                 INX     D
104D 23                 INX     H
104E 05                 DCR     B
104F C24810             JNZ     MOVPHA
1052 79                 MOV     A,C
1053 C630               ADI     ZERO            ; STORE 0 ON SCREEN
1055 32C8CF             STA     ETV-LENL+11
1058 D630               SUI     ZERO            ;CONVERT TO HEX
105A 07                 RLC                     ; *2
105B 07                 RLC                     ; *4
105C 07                 RLC                     ; *8
105D 1600               MVI     D,00H           ; A=PHASE*8
105F 5F                 MOV     E,A
1060 2A1016             LHLD    CTLPTR          ; PRINTER CONTROL
1063 19                 DAD     D               ; BUMP TO PROPER TABLE VALUES
                        ;
                        ;    MOVE PROPER CONTROL PARAMETERS BY PHASE
                        ;
1064 110816             LXI     D,LNEWF         ; POINT TO PHASE CONTROL TABLE
1067 0608               MVI     B,8             ; WHICH HAS 9 VALUES
1069 7E         TRPHA:  MOV     A,M
106A 12                 STAX    D
106B 23                 INX     H               ; INCREMENT LOCATIONS
106C 13                 INX     D
106D 05                 DCR     B               ; DECREMENT COUNTER
106E C26910             JNZ     TRPHA           ; ... AND LOOP 9 TIMES
1071 3E00               MVI     A,0             ;CLEAR COUNTER
1073 32E315             STA     BIGTWO
1076 C9                 RET                     ;
1077 3A0716     BMTPHA: LDA     PHASE           ; SET NEW PHASE
107A FE09               CPI     009H            ; VALIDATE NUMBER
107C C8                 RZ                      ;
107D 3C                 INR     A               ; AND ONE
107E 320716             STA     PHASE           ;
1081 CD3F10             CALL    SETPHA          ;
1084 C9                 RET                     ;
1085 E1         STOP:   POP     H               ; RESET VICTIM POINTER
1086 CD4912     GETPHA: CALL    INPUT
1089 FE30               CPI     '0'             ;
108B D8                 RC                      ;
108C FE39               CPI     '9'+1           ;
108E D0                 RNC                     ;
108F D630               SUI     '0'             ; SUBTRACT OFF ASCII PART OF NUMBER
1091 320716             STA     PHASE           ; SET PHASE TO INPUT VALUE
1094 CD3F10             CALL    SETPHA
1097 C9                 RET                     ;
                        ;
                        ;*****************************************************
                        ;
                        ;    SUBROUTINE TO ADD TO SCORE
                        ;
1098 3A0716     ADDSCR: LDA     PHASE   ; GET PHASE
109B 3C                 INR     A               ; AND ONE
109C 47                 MOV     B,A
109D 21F4CF             LXI     H,STV-12        ; SCORE MESSAGE DTV POS
10A0 CD0D10     MORSCR: CALL    SCRPIT          ; INCREMENT SCORE BY 1/24
10A3 05                 DCR     B
10A4 C2A010             JNZ     MORSCR
10A7 21741A             LXI     H,VPOS          ; LOCATION OF VICTIM
10AA 56                 MOV     D,M
10AB 23                 INX     H
10AC 5E                 MOV     E,M
10AD CDFB13             CALL    CONVERT         ;   GET VICTIM X,Y
10B0 3A0616             LDA     GOODCAL         ; AT BONUS COLUMN?
10B3 BA                 CMP     D               ; HAS VICTIM TRAVERSED SCREEN?
10B4 C2B910             JNZ     CHKBMP          ;  NOPE
10B7 FE01               CPI     ONE             ;  SET BONUS COLUMN
10B9 C2C110             JNZ     LEFTCOL
10BC 3E3F               MVI     A,WIDTH-2
10BE C3C310             JMP     SETCOL
10C1 3E01       LEFTCOL: MVI    A,ONE
10C3 320616     SETCOL: STA     GOODCAL         ;
10C6 3A0F16             LDA     LBONUS          ; ADD BONUS TO SCORE
10C9 47                 MOV     B,A
10CA 21F4CF     GIVBON: LXI     H,STV-12        ; GIVE VICTIM BONUS
10CD C0FC10             CALL    ASCBMP
10D0 05                 DCR     B
10D1 C2CA10             JNZ     GIVBON
10D4 3AE315     CHKBMP: LDA     BIGTWO          ;  TIME TO CHANGE PHASE?
10D7 FE14               CPI     014H            ; ?
10D9 C0                 RNZ                     ;  NOT YET
10DA C37710             JMP     BMTPHA          ;
                        ;
                        ; SUBROUTINE TO BUMP SCORE
                        ;
10DD 3A0311     SCORIT: LDA     SCRCTR          ;
10E0 3C                 INR     A               ; INCREMENT SCORE
10E1 320311             STA     SCRCTR
10E4 FE20               CPI     020H            ;  TIME TO CHANGE SCORE?
10E6 C0                 RNZ                     ;
10E7 3E00               MVI     A,000H          ;  ZERO COUNTER
10E9 320311             STA     SCRCTR          ;
                        ;
                        ;    POINT TO RIGHT OF CHAR STRING
                        ;
10EC 7E         ASCBMP: MOV     A,M
10ED FE20               CPI     BLANK           ; IS IT BLANK?
10EF C2F510             JNZ     GOTDIG          ; NO, ITS A DIGIT
10F2 3631               MVI     M,ZERO+1        ; STORE 1
10F4 C9                 RET                     ;
10F5 FE39       GOTDIG: CPI     ZERO+9          ; IS IT 9?
10F7 C20011             JNZ     NOT9            ; NO, THEN GO ADD DIGIT
10FA 3630               MVI     M,ZERO          ; OTHERWISE, SET TO ZERO
10FC 2B                 DCX     H               ; AND CARRY
10FD C3EC10             JMP     ASCBMP          ; GO ADD DIGIT
1100 3C         NOT9:   INR     A               ; INCREMENT DIGIT
1101 77                 MOV     M,A             ; PICK UP DIGIT
1102 C9                 RET
                        ;
                        ; SUBROUTINE TO DECREMENT SCORE
                        ;
1103 03         SCRCTR: INX     B               ; DECREMENT SCORE
1104 7E         ASCDEC: MOV     A,M             ; PICK UP DIGIT
1105 FE20               CPI     BLANK           ; IS IT BLANK?
1107 CA2211             JZ      CNTDEC
110A FE30               CPI     ZERO            ; IS IT ZERO?
110C C21511             JNZ     NOTZERO         ; NO, GO SUBTRACT DIGIT
110F 3639               MVI     M,ZERO+9        ; YES, SET TO NINE AND ...
1111 2B                 DCX     H               ; AND POINT TO NEXT DIGIT
1112 C30411             JMP     ASCDEC          ; GO ADD DIGIT
                        ;
1115 3D         NOTZERO: DCR    A               ; ITS NOT ZERO, SUBTRACT DIGIT
1116 77                 MOV     M,A             ; AND SAVE ON SCREEN
1117 FE30               CPI     ZERO            ; IS IT ZERO?
1119 C0                 RNZ
111A 2B                 DCX     H               ; MODIFY PREVIOUS DIGIT
111B 3E20               MVI     A,BLANK         ; A REG. = BLANK
111D BE                 CMP     M
111E C0                 RNZ
111F 23                 INX     H
1120 77                 MOV     M,A             ; SAVE DIGIT
1121 C9                 RET
                        ;
1122 3EFF       CNTDEC: MVI     A,0FFH
1124 320516             STA     SCRFLG          ; SAVE IN SCORE LOCATION
1127 C9                 RET
                        ;
                        ;*****************************************************
                        ; PROGRAM CYCLE COUNTER
                        ;
1128 21E215     BIGCTR: LXI     H,BIGONE        ; LOAD SCORE LOW ORDER DIGIT
112B 34                 INR     M               ;
112C C0                 RNZ                     ;
112D 23                 INX     H               ;
112E 34                 INR     M               ;
112F C0                 RNZ                     ;
1130 23                 INX     H               ;
1131 34                 INR     M               ;
1132 C0                 RNZ                     ;
1133 23                 INX     H               ;
1134 34                 INR     M               ;
1135 C9                 RET                     ;
                        ;
                        ;*****************************************************
                        ;
                        ;    SUBROUTINE TO CREATE NEW FISH
                        ;
1136 3A0D16     NEWFISH: LDA    LNEWF           ; SHOULD WE BE CALLED?
1139 CDF211             CALL    RANDOM          ;
113C FE01               CPI     ONE             ;
113E C0                 RNZ                     ;
113F 3E04               MVI     A,FRATE         ;   RATE IS GAME SPEED
1141 CDF211             CALL    RANDOM          ;   SMALLER = FASTER
1144 FE00               CPI     000H            ;
1146 C0                 RNZ                     ;
1147 CDFD14             CALL    ALIVE           ;   YEP GET LAST FISH
114A 7C                 MOV     A,H             ;
114B B7                 ORA     A               ; SET AORD FLAGS
114C C25211             JNZ     GOTFISH         ;
114F 7D                 MOV     A,L             ;
1150 B7                 ORA     A               ; SET AORD FLAGS
1151 C8                 RZ                      ;
1152 3601       GOTFISH: MVI    M,ONE           ; NO FISH IN POND
1154 23                 INX     H               ; GOT SOME FISHES
1155 3E44               MVI     A,064H          ;  YOT SPEED
1157 CDF211             CALL    RANDOM          ;
115A 47                 MOV     B,A             ;
115B 3A0016             LDA     LTRACK          ;
115E B8                 CMP     B               ;
115F D26711             JNC     NOTRACK         ;
1162 3641               MVI     M,NOTRK         ; SETUP NON TRACKING FISH
1164 C36911             JMP     NOTRACK         ;
1167 3644       NOTRACK: MVI    M,FTRK          ;   SETUP TRACKING FISH
1169 23         NOTRACK: INX    H               ; FISH DOES NO  TRACKING
116A 3A0816             LDA     LSRNG           ;
116D CDF211             CALL    RANDOM          ;
1170 47                 MOV     B,A             ;
1171 3A0A16             LDA     LMINS           ;   MIN SPEED FR FISH
1174 80                 ADD     B               ;
1175 77                 MOV     M,A             ;  SET SPEED MAX (LONER=FASTER)
1176 2B                 DCX     H               ;
1177 2B                 DCX     H               ;
1178 77                 MOV     M,A             ;  SET SPEED COUNTER
1179 CDAC15             CALL    BUMP3           ;
117C E5                 PUSH    H               ;  SAVE POINTER
117D 3A0916             LDA     LSIDE           ;
1180 CDF211             CALL    RANDOM          ;
1183 FE03               CPI     003H            ;
1185 CA8911             JZ      BRNLFT          ;  FISH BORN ON SIDE
1188 FE02               CPI     002H            ;
118A CAAC11             JZ      BRNRHT          ;    RIGHT
118D FE01               CPI     ONE             ;
118F CA9F11             JZ      BRNTOP          ;    TOP
1192 06C0               MVI     B,SUBL          ;    BOTTOM,, SET DIRECTION OF F
1194 3E3E               MVI     A,WIDTH-2       ;
1196 21D0CF             LXI     H,ETV-  3+LENL  ;  FISH STARTING LINE
1199 110100             LXI     D,1             ;  BOTTOM LEFT BOARDER PLUS
119C C3C311             JMP     FBORN           ;
119F 0640       BRNTOP: MVI     B,LENL          ; FISH IS BORN FROM TOP BORDER
11A1 3E3E               MVI     A,WIDTH-2       ; LENGTH OF TOP
11A3 21A0CC             LXI     H,DTV+LENL      ;
11A6 110100             LXI     D,1             ;
11A9 C3C311             JMP     FBORN           ;
11AC 06FF       BRNRHT: MVI     B,0FFH          ; FISH EMERGES OF RIGHT SIDE
11AE 3E00               MVI     A,NLINES-3      ; LENGTH OF SIDE
11B0 213FCC             LXI     H,DTV+WIDTH-2   ; TAP RIGHT BORDER
11B3 114000             LXI     D,LENL          ;
11B6 C3C311             JMP     FBORN           ;
11B9 0601       BRNLFT: MVI     B,ONE           ; FISH EMERGES FROM LEFT SIDE
11BB 3E00               MVI     A,NLINES-3      ;
11BD 2101CC             LXI     H,DTV+01H       ;  TOP LEFT BOARDER
11C0 114000             LXI     D,LENL          ;
11C3 CDE211     FBORN:  CALL    RANDOM          ; FIND
11C6 3C                 INR     A               ;  WHERE TO PLACE FISH ON SIDE
11C7 19         MOVEIT: DAD     D               ; MOVE FISH  TO STARTING PNS
11C8 3D                 DCR     A               ;
11C9 C2C711             JNZ     MOVEIT          ;
11CC EB                 XCHG                    ;
11CD E1                 POP     H               ;
11CE 1A                 LDAX    D               ;   GET SYMBOL ON SCREEN
11CF FE20               CPI     BLANK           ; EMPTY?
11D1 CAD911             JZ      SETFISH         ; FISH, GO GET VICTIM!!!!
11D4 2B                 DCX     H               ;  KILL FISH
11D5 2B                 DCX     H               ;
11D6 364F               MVI     M,DEAD          ;
11D8 C9                 RET                     ;
                        ;
                        ;  STORE FISH IN LOCATION DESIGNATED BY DE REGS,
                        ;
11D9 70         SETFISH: MOV    M,B             ;SET DIRECTION
11DA 23                 INX     H               ;
11DB 72                 MOV     M,D             ;  SET LOCATION IN TABLE
11DC 23                 INX     H               ;
11DD 73                 MOV     M,E             ;
11DE 3E2A               MVI     A,FISH          ;
11E0 12                 STAX    D               ;  PUT FISH ON SCREEN
11E1 C9                 RET                     ;
                        ;
                        ;
                        ;*****************************************************
                        ;  SUBROUTINE TO COMPUTE RANDOM NUMBER   A-REG INTO A-REG
                        ;
11E2 C5         RANDOM: PUSH    B               ;  SAVE BC REGS,
11E3 E5                 PUSH    H               ;  SAVE HL REGS,
11E4 47                 MOV     B,A             ;  SAVE MAXIMUM RANDOM VALUE
```

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304  11E5  2AE015  RAND1:  LHLD    RPTP          ; LAST PROGRAM RANDOMIZER
305  11E8  0E08    MVI     C,H
306  11EA  7C      RAND3:  MOV     A,H           ; EXCLUSIVE OR BITS 3,12,14,15

307  11EB  0F              RRC
308  11EC  AC              XRA     H
309  11ED  0F              RRC
310  11EE  0F              RRC
311  11EF  AC              XRA     H
312  11F0  0F              RRC
313  11F1  AD              XRA     L
314  11F2  0F              RRC
315  11F3  0F              RRC
316  11F4  0F              RRC
317  11F5  EE01            XRI     1             ;ENSURE 0= 1
318  11F7  E601            ANI     1
319  11F9  29              DAD     H
320  11FA  85              ADD     L
321  11FB  6F              MOV     L,A
322  11FC  0D              DCR     C
323  11FD  C2EA11          JNZ     RAND3
324  1200  22E015  RAND:   SHLD    RPTR          ; SAVE RANDOMIZER
325  1203  7C              MOV     A,H           ;
326  1204  85              ADD     L             ;
327  1205  67              MOV     H,A           ; SAVE GENERATOR
328  1206  7B              MOV     A,R           ; SAVE LIMIT
329  1207  6F      RAND2:  MOV     L,A           ; SAVE MAX GENERATOR
330  1208  80              ADD     B             ; COMPUTE MOD
331  1209  B8              CMP     B             ; WRAP YET?
332  120A  D20712          JNC     RAND2         ; NOPE, LOOP
333  120D  7C              MOV     A,H           ; YES, GET GENERATOR
334  120E  BD              CMP     L             ; GREATER THAN MAX GENERATOR?
335  120F  D2E511          JNC     RAND1         ; YES, GET ANOTHER GENERATOR
336  1212  B8      TOPS:   CMP     B             ; IS NUMBER
337  1213  DA1A12          JC      GOTNUM        ;  RIGHT SIZE?
338  1216  90              SUB     B             ;  LOWER?
339  1217  C31212          JMP     TOPS          ;
340  121A  E1      GOTNUM: POP     H             ;
341  121B  C1              POP     B             ;
342  121C  C9              RET                   ;
343                 ;
344                 ;
345                 ;*****************************************************
346                 ;
347                 ;       INPUT AND PROCESS USER'S MOVE
348                 ;
349  121D  DB00     USER:   IN      INSTAT        ; CHECK KEYBOARD  INPUT STATUS
350  121F  E601             ANI     RDA           ; ANY CHARACTERS INPUT?
351  1221  C8               RZ                    ;  RDA BIT NOT SET (NO INPUT)
352  1222  CD4912           CALL    INPUT         ;INPUT A CHARACTER
353  1225  2B               DCX     H             ; BACK TO SPEED
354  1226  3601             MVI     M,1           ; CLEAR TO 1
355  1228  CD8C15           CALL    RUMP3         ; POINT TO DIRECTION
356  122B  E5               PUSH    H             ;
357  122C  211E18           LXI     H,CHARS       ; POINT TO LOOKUP TABLE
358  122F  061C             MVI     B,CHARL       ; GET LENGTH
359  1231  BE      COMP:   CMP     M             ; ACC = CHAR?
360  1232  CA3C12           JZ      FOUND         ; YES, PROCESS IT
361  1235  23               INX     H             ; CHECK NEXT CHAR
362  1236  05               DCR     B             ; LOWER COUNT
363  1237  C23112           JNZ     COMP          ; COMPARE WITH WHOLE TABLE
364  123A  E1      RETURN: POP     H             ;RESTORE POINTER
365  123B  C9               RET                   ; DONE, NOFIND
366  123C  3E1C    FOUND:  MVI     A,CHARL       ; ADJUST COUNT
367  123E  90               SUB     B             ; TO BE A POINTER
368  123F  FEFE             ANI     0FEH          ; TWO ITEMS PER ACTION
369  1241  2618             MVI     H,JUMPS SHR 8 ; GET JUMP TABLE
370  1243  6F               MOV     L,A           ; POINT TO ENTRY
371  1244  5E               MOV     E,M           ; GET LOW
372  1245  23               INX     H             ; POINT TO HIGH
373  1246  56               MOV     D,M           ; GET HIGH
374  1247  EB               XCHG                  ; POINT TO ROUTINE ADDRESS
375  1248  E9               PCHL                  ; GO TO IT
376                 ;*****************************************************
377                 ;
378                 ; INPUT ROUTINE
379                 ;
380  1249  DB00     INPUT:  IN      INSTAT
381  124B  E601             ANI     RDA
382  124D  CA4912           JZ      INPUT
383  1250  DB01             IN      INDAT
384  1252  E67F             ANI     7FH
385  1254  C9               RET
386                 ;*****************************************************
387                 ;
388                 ;   ROUTINE TO SET DIRECTION OF MOVEMENT
389                 ;
390  1255  3EC0     UP:     MVI     A,SUBL        ;   MOVE UP
391  1257  C37A12           JMP     MOVHIM        ;
392  125A  3E01     RIGHT:  MVI     A,ONE         ;
393  125C  C37A12           JMP     MOVHIM        ;
394  125F  3E40     DOWN:   MVI     A,LENL        ;
395  1261  C37A12           JMP     MOVHIM        ;
396  1264  3EFF     LEFT:   MVI     A,0FFH        ;
397  1266  C37A12           JMP     MOVHIM        ;
398  1269  3EBF     UL:     MVI     A,SUBL-1      ;  MOVE DOWN
399  126B  C37A12           JMP     MOVHIM        ;
400  126E  3EC1     UR:     MVI     A,SUBL+1      ;  MOVE RIGHT
401  1270  C37A12           JMP     MOVHIM        ;
402  1273  3E41     LR:     MVI     A,LENL+1      ;  MOVE TO LOWER-RIGHT SQUARE
403  1275  C37A12           JMP     MOVHIM        ;
404  1278  3E3F     LL:     MVI     A,LENL-1      ;  MOVE TO LOWER-RIGHT SQUARE
405  127A  E1       MOVHIM: POP     H             ; RESTORE VICTIM POINTER
406  127B  BE               CMP     M             ; SOULD VICTIM
407  127C  CA8412           JZ      SDIREC        ;  MOVE IN SAME DIRECTION?
408  127F  77               MOV     M,A           ;  NO SET DISPLACEMENT
409  1280  2B               DCX     H             ;
410  1281  3617             MVI     M,VMAXS       ; AND SET SPEED
411  1283  C9               RET                   ;
412  1284  2B       SDIREC: DCX     H             ; SET DIRECTION
413  1285  3607             MVI     M,VFAST       ; VERY FAST SPEED
414  1287  C9               RET                   ;
415  1288  E1       HALT:   POP     H             ; RESTORE VICTIM POINTER
416  1289  3600             MVI     M,000H        ; ZAT DIRECTION
417  128B  C9               RET
418                 ;
419  128C  E1       AUTO:   POP     H             ; RESTORE VICTIM POINTER
420  128D  3A0516           LDA     SCRFLG        ;
421  1290  2F               CMA                   ;
422  1291  320516           STA     SCRFLG        ;
423  1294  C9               RET                   ;
424  1295  012818    ESC:    LXI     B,CHARGO      ; CHARACTER LOOKUP TBL
425  1298  113818           LXI     D,STRING      ; PARCING STRING
426  129B  2100CC           LXI     H,ATY         ; WHERE TO ASK
427  129E  1A       ESC1:   LDAX    D             ; GET DISPLAY CHAR
428  129F  13               INX     D             ; POINT TO NEXT DISPLAY
429  12A0  FEFF             CPI     0FFH          ; LAST CHARACTER?
430  12A2  CA0010           JZ      RESTART       ; YES, GO AWAY
431  12A5  F600             ORI     BIAS          ; SETUP TO OUTPUT
432  12A7  77               MOV     M,A           ; PUT IT ON SCREEN
433  12A8  23               INX     H             ; NEXT SCREEN LOCATION
434  12A9  FE2D             CPI     '-'+BIAS      ; NEED USER INPUT?
435  12AB  C29E12           JNZ     ESC1          ; NO, PRINT ANOTHER
436  12AE  CD8712           CALL    GPT           ; GET, SAVE, & PUT CHAR
437  12B1  3620             MVI     M,BLANK       ; STORE BLANK
438  12B3  23               INX     H
439  12B4  C39E12           JMP     ESC1          ; GET 'EM ALL
440  12B7  CD4912   GET:    CALL    INPUT         ; GET USER CHARACTER
441  12BA  FE1B             CPI     1BH           ; IS CHARACTER ESC?
442  12BC  CA0010           JZ      RESTART       ; YES, GO AWAY
443  12BF  02               STAX    B             ; SAVE CHARACTER
444  12C0  03               INX     B             ; BUMP TO NEXT ONE
445  12C1  03               INX     B             ; BUMP TO NEXT ONE
446  12C2  F600             ORI     BIAS          ; SET TO OUTPUT
447  12C4  77               MOV     M,A           ; PUT ON SCREEN
448  12C5  23               INX     H             ; NEXT POSITION
449  12C6  C9               RET                   ; RETURN
450                 ;
451                 ;*****************************************************
452                 ;
453                 ; AUTO PILOT  ROUTINE TO MOVE VICTIM
454                 ;
455  12C7  217018   VMOVE:  LXI     H,VTARL       ; POINT HL TO
456  12CA  7E               MOV     A,M           ;  VICTIM SPEED COUNTER
457  12CB  FE01             CPI     ONE           ; IS IT ONE?
458  12CD  C0               RNZ                   ;
459  12CE  3AF1CF           LDA     STV     -15   ; POINT TO SCORE MESSAGE
460  12D1  FE30             CPI     BLANK         ; IS SCORE LESS THAN 10000?
461  12D3  C8               RZ                    ; RETURN, IF IT IS.
462  12D4  21F4CF           LXI     H,      STV-12 ; POINT TO BEGINNING OF SCORE
463  12D7  CD0411           CALL    ASCDEC        ; DECREMENT SCORE
464  12DA  217418           LXI     H,VPOS        ; POINT TO POSITION OF VICTIM
465  12DD  46               MOV     B,M           ; ANDRESS TO B-C
466  12DE  23               INX     H             ; CHECK FOR NEIGHBORS
467  12DF  4E               MOV     C,M           ;
468  12E0  CD4813           CALL    NBR1          ;
469  12E3  57               MOV     D,A           ;

470  12E4  2B               DCX     H             ;
471  12E5  2B               DCX     H             ;
472  12E6  7E               MOV     A,M           ;
473  12E7  B7               ORA     A             ; SET 8080 FLAGS
474  12E8  C2FB12           JNZ     MOVING        ;
475  12EB  3A0616           LDA     GOODCAL       ; LOAD REWARD COUNT
476  12EE  FE01             CPI     ONE           ;
477  12F0  3EFF             MVI     A,0FFH        ;
478  12F2  CAF712           JZ      EQUAL1        ;
479  12F5  3E01             MVI     A,ONE         ;
480  12F7  77       EQUAL1: MOV     M,A           ; TOGGLE REWARD COUNT
481  12F8  CD8C13   MOVING: CALL    NBR3          ;
482  12FB  5F               MOV     E,A           ;
483  12FC  07               RLC                   ;
484  12FD  83               ADD     E             ;
485  12FE  5F               MOV     E,A           ;
486  12FF  0F               RRC                   ;
487  1300  83               ORA     E             ;
488  1301  5F               MOV     E,A           ;
489  1302  A2               ANA     D             ;
490  1303  B7               ORA     A             ; SET 8080 FLAGS
491  1304  C8               RZ                    ;
492  1305  0607             MVI     B,007H        ;
493  1307  3A1013           LDA     ROTATE        ;
494  130A  EE04             XRI     004H          ;
495  130C  321013           STA     ROTATE        ;
496  130F  7B       WAY3:   MOV     A,E           ;
497  1310  07       ROTATE: RLC                   ; ROTATE TABLE
498  1311  5F               MOV     E,A           ;
499  1312  A2               ANA     D             ;
500  1313  B7               ORA     A             ; SET 8080 FLAGS
501  1314  CA3113           JZ      GOTWAY        ;
502  1317  05               DCR     B             ;
503  1318  C20F13           JNZ     WAY3          ;
504  131B  7B               MOV     A,E           ;
505  131C  07               RLC                   ;
506  131D  07               RLC                   ;
507  131E  A3               ANA     E             ;
508  131F  5F               MOV     E,A           ;
509  1320  0608             MVI     B,008H        ;
510  1322  7B       WAY1:   MOV     A,E           ;
511  1323  0F               RRC                   ;
512  1324  5F               MOV     E,A           ;
513  1325  A2               ANA     D             ;
514  1326  B7               ORA     A             ; SET 8080 FLAGS
515  1327  CA3713           JZ      FINDIREC      ;
516  132A  05               DCR     B             ;
517  132B  C22213           JNZ     WAY1          ;
518  132E  3600             MVI     M,000H        ;
519  1330  C9               RET                   ;
520  1331  7B       GOTWAY: MOV     A,E           ; FOUND ESCAPE
521  1332  07               RLC                   ;
522  1333  5F               MOV     E,A           ;
523  1334  0F               RRC                   ;
524  1335  0F               RRC                   ;
525  1336  A3               ANA     E             ;
526  1337  CD8513   FINDIREC: CALL    NBR2          ;
527  133A  77               MOV     M,A           ;
528  133B  0607             MVI     B,007H        ;
529  133D  21F3CF   SUBLOOP: LXI     H,STV-13      ;
530  1340  CD0411           CALL    ASCDEC        ;
531  1343  05               DCR     B             ;
532  1344  C23D13           JNZ     SUBLOOP       ;
533  1347  C9               RET                   ;
534                 ;
535                 ; AC HAS VCTIM POSITION
536                 ; ACC WILL HAVE MASK OF IMMEDIATE NEIGHBORS
537                 ;    ON RETURN
538                 ;
539  134B  E5       NBR1:   PUSH    H             ;  SAVE H AND L
540  134C  21C715           LXI     H,NBTB2       ;
541  134F  3E00             MVI     A,000H        ;  CLEAR COUNT
542  1351  32DF15           STA     COUNT         ;
543  1354  3E08             MVI     A,008H        ;
544  1356  32DE15   LOOP1:  STA     LCTR          ;
545  1359  7E               MOV     A,M           ;
546  135A  B7               ORA     A             ; SET 8080 FLAGS
547  135B  5F               MOV     E,A           ;
548  135C  1600             MVI     D,000H        ;
549  135E  F26013           JP      FWD           ;
550  1361  16FF             MVI     D,0FFH        ;
551  1363  EB       FWD:    XCHG                  ;
552  1364  09               DAD     B             ;
553  1365  7E               MOV     A,M           ;
554  1366  EB               XCHG                  ;
555  1367  23               INX     H             ;
556  1368  FE20             CPI     BLANK         ;
557  136A  CA7713           JZ      NONBR         ;
558  136D  FE40             CPI     BORDER        ;
559  136F  CA7713           JZ      NONBR         ;
560  1372  56               MOV     D,M           ;
561  1373  3ADF15           LDA     COUNT         ;
562  1376  82               ADD     D             ;
563  1377  32DF15           STA     COUNT         ;
564  137A  23       NONBR:  INX     H             ; NOT A NEIGHBOR
565  137B  23               INX     H             ;
566  137C  3ADE15           LDA     LCTR          ;
567  137F  3D               DCR     A             ;
568  1380  C25313           JNZ     LOOP1         ;
569  1383  3ADF15           LDA     COUNT         ;
570  1386  E1               POP     H             ;
571  1387  C9               RET                   ;
572                 ;
573                 ;  CONVERT NEIGHBOR NUMBER TO DISPLACEMENT
574                 ;
575  1388  E5       NBR2:   PUSH    H             ;
576  1389  21C615           LXI     H,NPTB1       ;
577                 ;
578                 ;   CONVERT DISPLACEMENT TO NEIGHBOR NUMBER
579                 ;
580  138C  C39013           JMP     NXTENT        ;
581  138F  E5       NBR3:   PUSH    H             ;
582  1390  21C715           LXI     H,NBTB2       ;
583  1393  BE       NXTENT: CMP     M             ; PROCESS NEXT ENTRY
584  1394  CA9A13           JZ      FINDENT       ;
585  1397  CD8C15           CALL    RUMP3         ;
586  139A  C39013           JMP     NXTENT        ;
587  139D  23       FINDENT: INX    H             ;
588  139E  7E               MOV     A,M           ;
589  139F  E1               POP     H             ;
590  13A0  C9               RET                   ;
591                 ;*****************************************************
592                 ;    MOVE THE FISHES
593                 ;
594  13A1  35       FISHY:  DCR     M             ; DECREMENT MOVE COUNT
595  13A2  C0               RNZ                   ; IS FISH READY? IF NOT, RETURN
596  13A3  3601             MVI     M,RATE        ; SLOW DOWN GAME-
597  13A5  CDFE11           CALL    RANDOM        ;
598  13A8  FE00             CPI     0             ;
599  13AA  C0               RNZ                   ;
600  13AB  23               INX     H             ;
601  13AC  7E               MOV     A,M           ;
602  13AD  FE4F             CPI     DEAD          ;  IS FISH DEAD?
603  13AF  C8               RZ                    ; RETURN --- IF HE IS
604  13B0  FE58             CPI     MARKED        ; IF NOT, SHOULD WE KILL HIM?
605  13B2  CAB914           JZ      DIE           ; OK
606  13B5  E5               PUSH    H             ;  NO, GIVE HIM ANOTHER CHANCE
607  13B6  FE44             CPI     FISH          ; IS FISH TRACKING?
608  13B8  CC1914           CZ      TRACK         ; IF SO, CALL TRACKING ROUTINE
609  13BB  E1               POP     H             ; RESTORE POINTERS
610  13BC  23               INX     H             ;
611  13BD  7E               MOV     A,M           ; LOCATION OF FISH
612  13BE  2B               DCX     H             ;
613  13BF  2B               DCX     H             ;
614  13C0  77               MOV     M,A           ; SET SPEED
615  13C1  CD8C15           CALL    RUMP3         ;  MOVE POINTER BACK TO OTHER HALF OF LO
616  13C4  1600             MVI     D,000H        ;
617  13C6  5E               MOV     E,M           ; GET IT
618  13C7  7B               MOV     A,E           ;
619  13C8  B7               ORA     A             ; SET 8080 FLAGS
620  13C9  C8               RZ                    ;
621  13CA  B7               ORA     A             ; SET 8080 FLAGS
622  13CB  F2D013           JP      FRWARD        ;
623  13CE  16FF             MVI     D,0FFH        ;
624                 ;
625                 ;  SEE IF OBJECT TO MOVE IS ALIVE
626                 ;
627  13D0  23       FRWARD: INX     H             ; MOVE FORWARD
628  13D1  46               MOV     B,M           ;  PICK UP CURRENT POSITION OF OBJECT
629  13D2  23               INX     H             ;
630  13D3  4E               MOV     C,M           ;
631  13D4  0A               LDAX    B             ;  PICK UP OBJECT AND LOOK AT IT
632  13D5  FE30             CPI     BLANK         ; IS IT ALIVE?
633  13D7  C2E013           JNZ     MOVER         ;  IF SO, GO MOVE IT
634  13DA  CDC115           CALL    DECR          ;
635  13DD  3648             MVI     M,DEAD        ;  OTHERWISE, SIGN WARRANT
636  13DF  C9               RET                   ;
```

```
                        ;
                        ;  MOVE FISH OR WHATEVER TO NEW POSITION
                        ;
13D0  E5        MOVER:  PUSH    H               ; SAVE TABLE LOCATION
13DE  60                MOV     H,B             ;  MOVE DISPLACEMENT TO HL
13DF  69                MOV     L,C             ;
13E0  19                DAD     D               ;  ADD CURRENT POSITION ADDRESS
13F1  EB                XCHG                    ;  DE NOW CONTAINS NEW POSITION
13E2  E1                POP     H               ;
13E3  1A                LDAX    D               ;  WHAT'S IN NEW POSITION?
13E4  FEA0              CPI     BORDER          ;   HAVE WE HIT THE BORDER?
13E6  CA8014            JZ      HITBDR          ;    GO TO HIT BORDER INDICATION (?)
13E9  FE20              CPI     BLANK           ; DID WE NOT HIT ANYTHING?
13EB  C29414            JNZ     BANG4           ;  IF WE DID, DO EXPLOSION THING.
13EE  28                DCX     H               ;  OTHERWISE, SAVE NEW POSITION
13EF  72                MOV     M,D             ;
13F0  23                INX     H               ;
13F1  73                MOV     M,E             ;  IN CONTROL TABLE
13F2  84                LDAX    B               ;  PICK UP SYMBOL OF FISH-VICTIM-BOOM
13F3  12                STAX    D               ;  AND SAVE IT IN NEW LOCATION
13F4  3E20              MVI     A,BLANK         ; AND BLANK OUT OLD LOCATION
13F6  02                STAX    B               ;
13F7  C9                RET                     ;
                        ;
                        ; CONVERT ADDRESS TO LINE,COL IN D AND E REG
                        ;
13F8  C5        CONVERT: PUSH   B               ; SAVE BC

13F9  210034            LXI     H,-DTV          ;
13FC  19                DAD     D               ;
13FD  11C0FF            LXI     D,-LENL         ;
1400  0610              MVI     B,NLINES        ;
1402  19        FINEG:  DAD     D               ; LOOP UNTIL VALUE IS NEGATIVE
1403  05                DCR     B               ;
1404  7C                MOV     A,H             ;
1405  B7                ORA     A               ; SET 8080 FLAGS
1406  F20214            JP      FINEG           ;
1409  58                MOV     E,B             ;
140A  70                MOV     A,L             ;
140B  C640              ADI     LENL            ;
140D  57                MOV     D,A             ;
140E  C1                POP     B               ;
140F  C9                RET                     ;
                        ;
                        ;  FISH, TRACK VICTIM
                        ;
1410  3E64      TRACK:  MVI     A,064H          ; GET RANDOM NUMBER LESS THAN 64
1412  CDF211            CALL    RANDOM          ;
1415  47                MOV     B,A             ;
1416  3A0E16            LDA     LSTRK           ;
1419  B8                CMP     B               ; RETURN IF   CONTENTS OF 711H
141A  D8                RC                      ; RETURN, FISH, YOU ARE NOT A TRACKER
141B  CDAC15            CALL    BUMP3           ;
141E  E5                PUSH    H               ;
141F  56                MOV     D,M             ;
1420  23                INX     H               ;
1421  5E                MOV     E,M             ;
1422  CDFB13            CALL    CONVERT         ; CONVERT FISH POSITION
1425  42                MOV     B,D             ;
1426  4B                MOV     C,E             ;
1427  3A7418            LDA     VPOS            ;
142A  57                MOV     D,A             ;
142B  3A7518            LDA     VPOS+1          ;
142E  5F                MOV     E,A             ;
142F  CDFB13            CALL    CONVERT         ; CONVERT VICTIM POSITION
1432  78                MOV     A,B             ;
1433  92                SUB     D               ;
1434  57                MOV     D,A             ;
1435  FE7F              CPI     07FH            ;
1437  DA3A14            JC      POS1            ; PLUS?
143A  2F                CMA                     ;  ABS VALUE IN LINES
143B  47        POS1:   MOV     B,A             ; SAVE ABS DISTANCE
143C  79                MOV     A,C             ;
143D  93                SUB     E               ;
143E  5F                MOV     E,A             ;  SAVE DISTANCE IN COLS
143F  B7                ORA     A               ; SET 8080 FLAGS
1440  F24414            JP      POS2            ;
1443  2F                CMA                     ;
1444  B8        POS2:   CMP     B               ; CLOSER IN LINES OR COLS?
1445  DA5714            JC      TRKLIN          ;
1448  7B                MOV     A,E             ; GET COL DISTANCE
1449  B7                ORA     A               ; SET 8080 FLAGS
144A  FA5214            JM      MOVEUP          ;
144D  3E40              MVI     A,LENL          ;  MOVE DOWN
144F  C35A14            JMP     SETDIR          ;
1452  3E00      MOVEUP: MVI     A,-LENL         ; MOVE UP
1454  C35A14            JMP     SETDIR          ;
1457  7A        TRKLIN: MOV     A,D             ;
1458  B7                ORA     A               ; SET 8080 FLAGS
1459  F26114            JP      MOVELFT         ;
145C  3E01              MVI     A,ONE           ;  MOVE RIGHT
145E  C36314            JMP     SETDIR          ;
1461  3EFF      MOVELFT: MVI    A,0FFH          ; MOVE LEFT
1463  E1        SETDIR: POP     H               ;
1464  2B                DCX     H               ;
1465  47                MOV     B,A             ;
1466  7E                MOV     A,M             ;
1467  B8                CMP     B               ;
1468  C8                RZ                      ;
1469  2F                CMA                     ;
146A  B8                CMP     B               ;
146B  CA7014            JZ      OPPOS           ;
146E  70                MOV     M,B             ;
146F  C9                RET                     ;
1470  FE00      OPPOS:  CPI     SUBL            ;
1472  CA7D14            JZ      MOVRHT          ;
1475  FE40              CPI     LENL            ;
1477  CA7D14            JZ      MOVRHT          ;
147A  3640              MVI     M,LENL          ;
147C  C9                RET                     ;
147D  3601      MOVRHT: MVI     M,ONE           ;  MOVE TO RIGHT
147F  C9                RET                     ;
                        ;
                        ;     MOVER HIT BORDER WHILE MOVING
                        ;
1480  CDC115    HITBDR: CALL    DEC4            ; GET TYPE
1483  7E                MOV     A,M             ;
1484  FE50              CPI     VICTIM          ;
1486  CA8E14            JZ      VHIT            ; IS THIS THE VICTIM?
1489  2B                DCX     H               ; POINT TO CTL TABLE
148A  CDF014            CALL    KILL            ;
148D  C9                RET                     ;
148E  3E00      VHIT:   MVI     A,000H          ; STOP THE VICTIM
1490  23                INX     H               ;
1491  23                INX     H               ;
1492  77                MOV     M,A             ;
1493  C9                RET                     ;
1494  CDC015  BANG4:  CALL    DEC5            ; OUTPUT 4 +'S
1497  CDF014            CALL    KILL            ;
149A  CD1415            CALL    FIND            ;
149D  CDF014            CALL    KILL            ;
14A0  210100            LXI     H,ONE           ;
14A3  09                DAD     B               ;
14A4  CDC214            CALL    BANG            ;
14A7  21FFFF            LXI     H,0FFFFH        ;
14AA  09                DAD     B               ;
14AB  CDC214            CALL    BANG            ;
14AE  214000            LXI     H,LENL          ;
14B1  09                DAD     B               ;
14B2  CDC214            CALL    BANG            ;
14B5  21C0FF            LXI     H,-LENL         ;
14B8  09                DAD     B               ;
14B9  CDC214            CALL    BANG            ;
14BC  C9                RET                     ;
14BD  2B        DIE:    DCX     H               ; SET OBJECT DEAD
14BE  CDF014            CALL    KILL            ;
14C1  C9                RET                     ;
14C2  7E        BANG:   MOV     A,M             ; + TO DTV
14C3  FE20              CPI     BLANK           ;
14C5  CAD914            JZ      EMPTY           ;
14C8  FEA0              CPI     BORDER          ;
14CA  C8                RZ                      ;
14CB  FE2B              CPI     BOOM            ;
14CD  C8                RZ                      ;
14CE  E5                PUSH    H               ;
14CF  C5                PUSH    B               ;
14D0  EB                XCHG                    ;
14D1  CD1415            CALL    FIND            ;
14D4  CDF014            CALL    KILL            ;
14D7  C1                POP     B               ;
14D8  E1                POP     H               ;
14D9  EB        EMPTY:  XCHG                    ; CELL IS EMPTY
14DA  C5                PUSH    B               ;
14DB  CDF014            CALL    ALIVE           ;
14DE  C1                POP     B               ;
14DF  3A0C16            LDA     LTIME           ;
14E2  77                MOV     M,A             ;
14E3  23                INX     H               ;
14E4  3658              MVI     M,MARKED        ;
14E6  CDAC15            CALL    BUMP3           ;
14E9  72                MOV     M,D             ;
14EA  23                INX     H               ;
14EB  73                MOV     M,E             ;
14EC  3E2B              MVI     A,BOOM          ;
14EE  12                STAX    D               ;
14EF  C9                RET                     ;
14F0  23        KILL:   INX     H               ; SET DIE FLAG IN TABLE
14F1  364F              MVI     M,DEAD          ;
14F3  CDAC15            CALL    BUMP3           ;
14F6  46                MOV     B,M             ;
14F7  23                INX     H               ;
14F8  4E                MOV     C,M             ;
14F9  3E20              MVI     A,BLANK         ;
14FB  02                STAX    B               ;
14FC  C9                RET                     ;
                        ;
                        ;  POINT TO LAST ALIVE FISH IN POND
                        ;
14FD  217718    ALIVE:  LXI     H,FTABL+1       ; HL POINTS TO TABLE
1500  061A              MVI     B,MAXFISH       ;
1502  7E        MORDEAD: MOV    A,M             ; JUMP OVER ALL BUT  DEAD FISH
1503  FE4F              CPI     DEAD            ;
1505  CA1215            JZ      FNDEAD          ;
1508  CDB915            CALL    BUMP6           ;
150B  05                DCR     B               ;
150C  C20215            JNZ     MORDEAD         ;
150F  210100            LXI     H,ONE           ;
1512  2B        FNDEAD: DCX     H               ; FOUND A DEAD ONE
1513  C9                RET                     ;
                        ;
                        ;   FIND FISH THAT MATCHES ADDRESS IN DE-REG
                        ;
1514  217018    FIND:   LXI     H,VTABL         ; POINT TO FISH TABLE
1517  061A              MVI     B,MAXFISH+1     ;
1519  CDB815    LOOK:   CALL    BUMP4           ; HL=HL+4
151C  7E                MOV     A,M             ;
151D  23                INX     H               ;
151E  BA                CMP     D               ;
151F  C22815            JNZ     NOFIND          ;
1522  7E                MOV     A,M             ;
1523  BB                CMP     E               ;
1524  C22815            JNZ     NOFIND          ;
1527  CDC015            CALL    DEC5            ;
152A  C9                RET                     ;
152B  23        NOFIND: INX     H               ; NOT FOUND
152C  05                DCR     B               ;
152D  C21915            JNZ     LOOK            ;
1530  210000            LXI     H,0000H         ;
1533  C9                RET                     ;
                        ;
                        ;*****************************************************
                        ;   GAME INITIALIZATION ROUTINES
                        ;
                        ; BLANK OUT SCREEN
                        ;
1534  21D0CC    SETUP:  LXI     H,DTV           ; HLE TOP OF DTV
1537  0610              MVI     B,NLINES        ; NUMBER OF LINES
1539  0E40      BLKCH:  MVI     C,LENL          ; LENGTH OF LINE
153B  3620      BLKEH:  MVI     M,BLANK         ; STORE BLANK CHARACTER
153D  23                INX     H               ;
153E  0D                DCR     C               ;
153F  C23B15            JNZ     BLKEH           ;  LOOP OVER WHOLE LINE
1542  05                DCR     B               ;  DECREMENT LINE COUNT
1543  C23915            JNZ     BLKCH           ;  LOOP FOR ALL LINES
                        ;
                        ;  SET UP TOP AND BOTTOM  BORDER
                        ;
1546  21D0CC            LXI     H,DTV           ; BEGINNING OF TOP BORDER
1549  11E0CF            LXI     D,DTV+2*LENL    ; BEGINNING OF BOTTOM BORDER
154C  0640              MVI     B,WIDTH         ; WIDTH OF SCREEN
154E  3EA0              MVI     A,BORDER        ; BORDER CHARACTER
1550  77        SETROR: MOV     M,A             ; SET TOP BORDER
1551  12                STAX    D               ; SET BOTTOM BORDER
1552  23                INX     H               ; BUMP BORDER POINTER
1553  13                INX     D               ;
1554  05                DCR     B               ; DECREMENT COUNT
1555  C25015            JNZ     SETROR          ; LOOP FOR WHOLE BORDER
                        ;
                        ;
                        ; SIDE BORDER SETUP
                        ;
1558  0E0E              MVI     C,NLINES-2      ; NUMBER OF LINES FOR BORDER
155A  21D0CC            LXI     H,DTV+LENL      ; POINT HL TO LEFT BORDER
1550  77        NXTROW: MOV     M,A             ;  LEFT SIDE
155E  0E3F              MVI     C,WIDTH-1       ;
1560  23       SETSIDE: INX     H               ;  CENTER FILL
1561  0D                DCR     C               ;
1562  C26015            JNZ     SETSIDE         ;
1565  77                MOV     M,A             ;    RIGHT SIDE
1566  0E01              MVI     C,LENL+1-WIDTH  ;
1568  23       PADSIDE: INX     H               ; RIGHT FILL
1569  0D                DCR     C               ;
156A  C26815            JNZ     PADSIDE         ;
156D  05                DCR     B               ;
156E  C25D15            JNZ     NXTROW          ;
                        ;
                        ;  SETUP UP PLAYER CONTROL AREA
                        ;
1571  217018            LXI     H,VTABL         ; PLAYER CONTROL TABLE
1574  3617              MVI     M,VMAXS         ; SET SPEED COUNTER
1576  23                INX     H               ;
1577  3650              MVI     M,VICTIM        ;SET WE ARE VICTIM
1579  23                INX     H               ;
157A  3617              MVI     M,VMAXS         ; SET SPEED MAX
157C  23                INX     H               ; INCREMENT H
157D  3600              MVI     M,000H          ;
157F  23                INX     H               ;
1580  01E0CD            LXI     B,DTV+LENL*NLINES/2-LENL+WIDTH/2 ; POSITION
1583  70                MOV     M,B             ; SET VICTIM LOCATION
1584  23                INX     H               ;
1585  71                MOV     M,C             ;
1586  3E07              MVI     A,VSYM          ; PUT VICTIM ON SCREEN
1588  02                STAX    B               ;
                        ;
                        ; CLEAR WORKING CONTROL   AREA OF FISH
                        ;
158A  161A              MVI     D,MAXFISH       ; MAXIMUM NUMBER OF FISH
158B  23        NOFISH: INX     H               ;  FISH CONTROL TABLE
158C  23                INX     H               ;      WORD  USE
158D                    ;                       ;   1     SPEED
158D  364F              MVI     M,DEAD          ;   2  TYPE FLAG
158F  CDBB15            CALL    BUMP4           ;   3   SPEED OF FISH ED
1592                    ;                       ;   4   DIRECTION
1592  15                DCR     D               ;  5-6   LOCATION OF FIS
1593  C28B15            JNZ     NOFISH          ;
                        ;
                        ;    SETUP SCORE MESSAGE
                        ;
1596  21F7CF            LXI     H,STV-25        ; LOCATION OF SCORE
1599  0614              MVI     B,014H          ; NUMBER OF CHARACTERS
159B  11E015            LXI     D,SCRMSG        ;
159E  1A        PRTSCR: LDAX    D               ;
159F  F680              ORI     BIAS            ; BIAS FOR POLYMORPHICS
15A1  77                MOV     M,A             ;
15A2  13                INX     D               ;
15A3  23                INX     H               ;
15A4  05                DCR     B               ;
15A5  C29E15            JNZ     PRTSCR          ;
15A8  3EFF              MVI     A,0FFH          ; SET
15AA  320516            STA     SCRFLG          ;SCORING FLAG
15AD  3E00              MVI     A,000H          ; DEFAULT PHASE
15AF  320716            STA     PHASE           ; SET
15B2  CD3A10            CALL    SETPHA          ; POINT
15B5  CD8A10            CALL    GETPHA          ; SETUP USERS INITIAL PHASE
15B8  C9                RET                     ;
                        ;*****************************************************
                        ;
                        ; POINTER MOVER ROUTINE
                        ;
15B9  23        BUMP6:  INX     H               ; HL=HL+6
15BA  23                INX     H               ;
15BB  23        BUMP4:  INX     H               ; HL=HL+4
15BC  23        BUMP3:  INX     H               ; HL=HL+3
15BD  23                INX     H               ;
15BE  23                INX     H               ;
15BF  C9                RET                     ;
15C0  2B        DEC5:   DCX     H               ; HL=HL-5
15C1  2B        DEC4:   DCX     H               ; HL=HL-4
15C2  2B        DEC3:   DCX     H               ; HL=HL-3
15C3  2B                DCX     H               ;
15C4  2B                DCX     H               ;
15C5  C9                RET                     ;
                        ;
                        ;*****************************************************
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                            ;
                            ; AUTO PILOT VICTIM MOVE DIRECTION  VS  NEIGHBOR TABLE
                            ; TABLES AND ASSORTED CONSTANTS
                            ;
15C6  01        NBTB1:  DB      1                ; AUTO PILOT VARIABLE
15C7  C00102    NBTB2:  DB      SUBL,1,2         ; DIRECTION VS   NEIGHBOR TABLE
15CA  C10204            DB      SUBL+1,2,4
15CD  010408            DB      1,4,8
15D0  410810            DB      LENL+1,8,10H
15D3  401020            DB      LENL,10H,20H
15D6  3F2040            DB      LENL-1,20H,40H
15D9  FF4080            DB      -1,40H,80H
15DC  BF80              DB      SUBL-1,80H
                        ;
15DE  08        LCTR:   DB      8
15DF  00        COUNT:  DB      0                ; LOOP COUNTER
                        ;
15E0  0000      RPTR:   DB      0,0              ; RANDOMIZER
15E2  00        BIGONE: DB      0                ; CYCLE COUNT
15E3  000000    BIGTWO: DB      0,0,0            ; 2ND, THIRD AND 4TH DIGIT
15E6  53434F52  SCRMSG: DB         'SCORE '
15EA  4520
15EC  20202020          DB  '      00       '
15F0  20203030
15F4  20202020
15F8  2020
15FA  50484153  PHAMSG: DB         'PHASE       '
15FE  45202020
1602  202020
1605  FF        SCRFLG: DB         0FFH          ; SCORE FLAG
1606  3E        GOODCAL: DB        WIDTH -2      ; LOCATION TO MOVE PASS TO GET REWARD
1607  00        PHASE:   DB        0             ; CURRENT PHASE
1608  64        LNEWF: DB          100           ; BIRTH RATE
1609  01        LSIDE: DB          1             ; NO SIDES FISH EMERGE
160A  14        LMINS: DB          20            ; MINIMUM SPEED
160B  50        LSRNG: DB          80            ; SPEED RANGE
160C  28        LTIME: DB          28H           ; TIME OF EXPLOSION
160D  01        LTRACK: DB          1            ; PERCENT OF TRACKERS
160E  01        LSTRK: DB          1             ; HOW OFTEN TRACKING
160F  00        LBONUS: DB          0            ; BONUS SCORE
1610  1316      CTLPTR: DW          CONTROL        ; ADDRESS TO CURRENT CONTROL TABLE
1612  16                DB          22
                        ;
                        ; PHASE CONTROL TABLE
                        ;             BIRTH  #    MIN    RANGE   TIME    %    TRACKING  BONUS
                        ;             RATE SIDES SPEED  SPEED  EXPLODE TRKERS  RATE     POINT
1613  40010260  CONTROL:  DB  040H,   1,   2H,   60H,    30H,   10,     1,      50
1617  300A0132
161B  4801265C            DB  048H,   1,  26H,   5CH,    30H,   20,     4,      75
161F  3014044B
1623  50012458            DB  050H,   1,  24H,   58H,    2CH,   30,     7,     100
1627  2C1E0764
162B  58012254            DB  058H,   1,  22H,   54H,    2CH,   40,    10,     125
162F  2C280A7D
1633  60022050            DB  060H,   2,  20H,   50H,    28H,   50,    13,     150
1637  28320D96
163B  68021E4C            DB  068H,   2,  1EH,   4CH,    28H,   60,    16,     175
163F  283C10AF
1643  70021C48            DB  070H,   2,  1CH,   48H,    24H,   70,    19,     200
1647  244613C8
164B  78021A44            DB  078H,   2,  1AH,   44H,    24H,   80,    22,     225
164F  245016E1
1653  80041840            DB  080H,   4,  18H,   40H,    20H,   90,    25,     250
1657  205A19FA
165B  8804163C            DB  088H,   4,  16H,   3CH,    20H,  100,    28,     255
165F  20641CFF
                        ;
0058                    MARKED    EQU     58H
0004                    FRATE     EQU     4          ; GAME SPEED CONTROL FOR NEW FISH
0001                    MRATE     EQU     1          ; SPEED CONTROL FOR MOVEMENT
                        ;
                        ;  I/O CONTROL PARAMETERS
                        ;
0001                    RDA       EQU     1          ; INPUT STATUS BIT        1
0001                    INDAT     EQU     1          ; INPUT DATA PORT         1
0000                    INSTAT    EQU     0          ; INPUT STATUS PORT       3
                        ;
0049                    FTRK      EQU     49H   ; FISH IS TRACKING
B800                    MONIT     EQU     0B800H   ; MONITOR
0041                    NOTRK     EQU     41H        ; FISH DOES NOT TRACK
0017                    VMAXS     EQU     17H        ; SPEED
0007                    VFAST     EQU     07H        ; FAST SPEED
0050                    VICTIM    EQU     50H          ; VICTIM SYMBOL
0040                    LENL      EQU      64          ; NUMBER OF CHARACTERS PER LINE
0040                    WIDTH     EQU     64           ; WIDTH OF PLAYING SCREEN
0020                    SCORSP    EQU     20H        ; THROTTLE FOR SCORE. =  FASTER
00C0                    SUBL      EQU     0C0H       ; ADDED TO  MOVE UP ONE LINE
                        ;
0000                    BIAS      EQU     00H       ; BIAS=0 FOR PROCESSOR TECH; 80H FOR POLYMORPH
0020                    BLANK      EQU    ' ' + BIAS ; BLANK CHARACTER
0030                    ZERO       EQU     '0'+BIAS ; CHARACTER '0'
0000                    BINO       EQU     0           ; BINARY ZERO
0001                    ONE        EQU     1           ; BINARY ONE
0007                    VSYM       EQU      7 +BIAS    ; VICTIM'S SYMBOL (BELL)
004F                    DEAD       EQU      04FH       ; COLLISION INDOCATOR
002B                    BOOM       EQU     '+'+BIAS    ; EXPLOSION SYMBOL
002A                    FISH       EQU     '*'+BIAS    ; PIRANHA SYMBOL
00A0                    BORDER     EQU     0A0H        ; BORDER CHARACTER
CC00                    DTV        EQU     0CC00H      ; LOCATION OF 1K 64X16 DTV MEMORY 0CC00
0010                    NLINES     EQU     16          ; NUMBER OF DTV DISPLAY LINES
D000                    ETV        EQU  DTV+LENL*NLINES ; END OF TV
D000                    STV        EQU  ETV-LENL+WIDTH ; LOCATION OF SCORE
001A                    MAXFISH    EQU  (NLINES+WIDTH)/3    ; NUMBER OF FISH
                        ;
                        ;
1800                              ORG      01800H
                        ;    JUMP TABLE TO ROUTINES
                        ;
1800  00B8      JUMPS:     DW          MONIT      ; USERS MONITOR
1802  9512                 DW          ESC        ; CHANGE CONTROL
1804  0010                 DW          RESTART    ;  START GAME OVER
1806  5512                 DW          UP         ; MOVE VICTIM UP
1808  5F12                 DW          DOWN       ; MOVE VICTIM DOWN
180A  6412                 DW          LEFT       ; MOVE VICTIM LEFT
180C  5A12                 DW          RIGHT      ; MOVE VICTIM RIGHT
180E  6912                 DW          UL
1810  6E12                 DW          UR
1812  7812                 DW          LL
1814  7312                 DW          LR
1816  A812                 DW          HALT
1818  8510                 DW          STOP
181A  8C12                 DW          AUTO
181C  3A12                 DW          RETURN
181E  FF01      CHARS:     DB          0FFH,01H    ; MONITOR RETURN
1820  1B1B                 DB           1BH,1BH   ; KEY REDEFINE
1822  530D      CHARGO:    DB           'S',0DH   ; START GAME OVER
1824  5538                 DB           'U','8'   ; MOVE UP
1826  4A32                 DB           'J','2'   ; MOVE DOWN
1828  4834                 DB           'H','4'   ; MOVE LEFT
182A  4B36                 DB           'K','6'   ; MOVE RIGHT
182C  5937                 DB           'Y','7'   ; MOVE UPPER LEFT
182E  4939                 DB           'I','9'   ; MOVE UPPER RIGHT
1830  4E31                 DB           'N','1'   ; MOVE LOWER LEFT
1832  2C33                 DB           ',','3'   ; MOVE LOWER RIGHT
1834  2035                 DB           ' ','5'   ; HALT THE VICTIM
1836  502E                 DB           'P','.'   ; STOP EVERYTHING-CHANGE PHASE
1838  4130                 DB           'A','0'   ; TOGGLE AUTO PILOT
183A  FF        ENDCH:     DB           0FFH        ; END OF TABLE
001C            CHARL      EQU          ENDCH-CHARS
183B  20454E54  STRING:    DB           ' ENTER NEW VALUES FOR: GO-'
183F  4552204E
1843  45572056
1847  414C5545
184B  5320464F
184F  523A2047
1853  4F2D
1855  552D                 DB           'U-'        ; MOVE UP
1857  442D                 DB           'D-'        ; MOVE DOWN
1859  4C2D                 DB           'L-'        ; MOVE LEFT
185B  522D                 DB           'R-'        ; MOVE LEFT
185D  554C2D               DB           'UL-'       ; MOVE UP-LEFT
1860  55522D               DB           'UR-'       ; MOVE UP RIGHT
1863  4C4C2D               DB           'LL-'       ; MOVE DOWN LEFT
1866  4C522D               DB           'LR-'       ; MOVE DOWN RIGHT
1869  482D                 DB           'H-'        ; STOP
186B  502D                 DB           'P-'        ; CHANGE PHASE
186D  412D                 DB           'A-'        ; TOGGLE AUTO PILOT
186F  FF                   DB           0FFH      ; END OF STRING
1870  17        VTABL:     DB         VMAXS ; SPEED
1871  50                   DB         VICTIM      ; VICTIM SYMBOL
1872  17        VSPEED:    DB         VMAXS ;          MAX SPEED OF VICTIM, LOWER =FASTER
1873  00        VDIREC:    DB         0  ;             DIRECTION OF VICTIM AS DISPLACEMENT
1874  E0CD      VPOS:      DW         DTV+LENL*( NLINES-1)/2      ; VICTIM INITIAL POSITION
004C            FTABL:     DS         MAXFISH*6    ; FISH TABLE
                                 END
   NO PROGRAM ERRORS
```

```
* 01                         SYMBOL TABLE

A      0007      ADDSC  1098      ALIVE  14FD      ASCRM  10EC
ASCDE  1104      AUTO   128C      B      0000      BANG   14C2
BANG4  1494      BIAS   0000      BIGCT  1128      BIGON  15E2
BIGTW  15E3      BINO   0000 *    BLANK  0020      BLKCH  1539
BLKEH  153B      BMTPH  1077      BOOM   002B      BORDE  00A0
BRNLF  11B9      BRNRH  11AC      BRNTO  119F      BUMP3  15BC
BUMP4  15BB      BUMP6  15B9      C      0001      CHARG  1822
CHARL  001C      CHARS  181E      CHKBM  10D4      CNTDE  1122
COMP   1231      CONTR  1613      CONVE  13F8      COUNT  15DF
CTLPT  1610      D      0002      DEAD   004F      DEC3   15C2 *
DEC4   15C1      DEC5   15C0      DIE    148D      DOTRA  1167
DOWN   125F      DTV    CC00      E      0003      EMPTY  1409
ENDCH  183A      EQUAL  12F7      ESC    1295      ESC1   129E
ETV    D000      FBORN  11C3      FIND   1514      FINDE  139A
FINDI  1337      FINEG  1402      FISH   002A      FISHE  102E
FISHT  139E      FNDEA  1512      FOUND  123C      FRATE  0004
FRWAR  13CD      FTABL  1876      FTRK   0049      FWD    1360
GET    12B7      GETPH  1086      GIVBO  10CA      GOODC  1606
GOTDI  10F5      GOTFI  1152      GOTNU  121A      GOTWA  1331
H      0004      HALT   1288      HITBD  1480      INDAT  0001
INPUT  1249      INSTA  0000      JUMPS  1800      KILL   14F0
L      0005      LBONU  160F      LCTR   15DE      LEFT   1264
LEFTC  10C1      LENL   0040      LL     1278      LMINS  160A
LNEWF  1608      LOOK   1519      LOOP1  1353      LR     1273
LSIDE  1609      LSRNG  160B      LSTRK  160E      LTIME  160C
LTRAC  160D      M      0006      MAINL  100A      MARKE  0058
MAXFI  001A      MONIT  B800      MORDE  1502      MORSC  10A0
MOVEI  11C7      MOVEL  1461      MOVER  13DD      MOVEU  1452
MOVHI  127A      MOVIN  12F8      MOVPH  1048      MOVPH  147D
MP1    1020      MRATE  0001      NBR1   134B      NBR2   1385
NBR3   138C      NBTB1  15C6      NBTB2  15C7      NEWFI  1136
NLINE  0010      NOFIN  152B      NOFIS  158B      NONBR  1377
NOT9   1100      NOTRA  1169      NOTRK  0041      NOTZE  1115
NXTEN  1390      NXTRO  155D      ONE    0001      OPPOS  1470
PADSI  1568      PHAMS  15FA      PHASE  1607      POS1   143B
POS2   1444      PRTSC  159E      PSW    0006      RAND   1200 *
RAND1  11E5      RAND2  1207      RAND3  11EA      RANDO  11E2
RDA    0001      RESTA  1000      RETUR  123A      RIGHT  125A
ROTAT  1310      RPTR   15E0      SCORI  100D      SCORS  0020 *
SCRCT  1103      SCRFL  1605      SCRMS  15E6      SDIRE  12B4
SETHO  1550      SETCO  10C3      SETDI  1463      SETFI  11D9
SETPH  103F      SETSI  1560      SETUP  1534      SP     0006
STOP   1085      STRIN  183B      STV    D000      SUBL   00C0
SUBLO  133D      TOPS   1212      TRACK  1410      TRKLI  1457
TRPHA  1069      UL     1269      UP     1255      UR     126E
USER   121D      VDIRE  1873 *    VFAST  0007      VHIT   148E
VICTI  0050      VMAXS  0017      VMOVE  12C7      VPOS   1874
VSPEE  1872 *    VSYM   0007      VTABL  1870      WAY1   1322
WAY3   130F      WIDTH  0040      ZERO   0030
```

PROGRAM OBJECT CODE LISTING

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2107B-4	4.00
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4096	4.50
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2513 DOWN	6.75
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82S129B	4.25
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8251	12.00
8253	28.00
8255	12.00
8257	25.00
8259	25.00

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		1-24	25-99	100
21L02	(450)	1.50	1.40	1.25
21L02	(250)	1.95	1.80	1.50
21L11		4.25	4.10	3.95
1101A		1.49	1.29	1.10
2101-1		2.95	2.75	2.60
2102		1.25	1.15	1.00
2102-1		1.50	1.30	1.15
2111-1		4.00	3.50	3.25
2112-1		3.00	2.80	2.69
2114		17.95	16.95	16.50
31L01		2.50	2.35	2.00
3107		3.95	3.70	3.25
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IM-6403	10.80

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1771B-01	59.95

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6522	9.25
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6530-003	15.95
6530-004	15.95
6530-005	15.95

USRT

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WD1671B	29.95

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8038	4.00
MC4024	2.50
566	1.75

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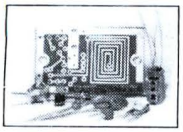

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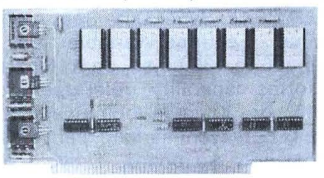

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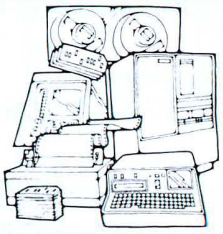

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FOR SALE: Oliver papertape reader $75.00, PolyMorphic VTI 64 video board $190.00, IMSAI audio cassette interface board $50.00. Practically unused. J. Williams, 2415 Ansdel Ct., Reston, VA 22091.

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WANTED: Early INTERFACE AGE magazines, Vol. 1, Issues 1, 2, 3, 4, 8. Ron Sanecki, 493 So. Pine Ave., So. Amboy, NJ 08879.

MICRODATA REALITY: Are there any other computer hobbyists using this system? If so, I'd like to say hello, swap notes and programs, etc. Would also like to know where to buy a 4- or 8-way video terminal interface card and other peripherals for Microdata Reality (Model 1600 cpu). Jack Hardman, 140 Forest Ave., Glen Ridge, NJ 07028, (201) 429-8880.

FOR SALE: Sphere 330. 20K memory, 6800 CPU, CRT & interface for cassette, keyboard, EPROM operating system: editor, mini-assembler, debug. $1200. John Nestor, Rt. 1, Box 166, Chelan, WA 98816.

SUPER DEAL: Syner Data Beta ASCII I/O terminal. Features variable pin feed platen (26 to 132 cols.), up to 6-part carbon forms capability, quiet operation at 10, 15, or 30 cps, local/RO/MDX/FDX modes, odd/even/marking parity select, microswitch keyboard, Univac Model 0179 printer, all common TTL/DTL ICs, full maintenance manual, user manual, and enlarged circuit diagrams, spare ink roller, and a wealth of spare parts, sufficient P.S. and room for micro in beautiful pedestal base cabinet. Has been totally rebuilt, adjusted and lubed and is in top shape both mechanically and physically. With paper supply basket, $695 (negotiable). Neil Ferguson, 116 Woodland Circle, Arlington, TX 76013, (214) 265-9054 evenings.

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WANTED: Information on using the Burroughs video display terminal offered by Meshna Surplus. Anyone who has hooked one up to their Altair or Imsai I would like to hear how you did it. Call or write James Burnham, 466 W. Washington, Apt. 86, El Cajon, CA 92022, (713) 440-2281.

FOR SALE: Flexowriter $195.00; Tally Tape punch w/power supply and CPU $165.00; Double pen Chart Recorder $75.00; F.O.B. J. Weaver, 16255 S.W. 82 Ave., Miami, FL 33157, (305) 238-4837 (would consider trade for microcomputer related items).

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FOR SALE: Altair 8800a with 20K RAM and ASR 33 teletype (almost new), reader, punch, interfaces, fan, manuals, etc. 8K MITS BASIC on paper tape. Cost almost $4000 new. Works perfectly but want to build my own now. Sacrifice this whole quality system for $2495, or just $1895 without the teletype. First cashier's check or money order reserves this powerful computer and teletype. Brian J. Dowd, D.D.S., 1770 Century Cir., N.E. Atlanta, GA 30345.

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FOR SALE: E&L Instruments MMD-1 8080a based computer, assembled and tested $315; CT-1024 terminal with power supply, assembled and tested, plus RS-232 serial board, parallel board, screen read board and cursor control board, all for $135. John Chong, 1718 Greenwich St., San Francisco, CA 94123, (415) 771-5496 after 6 P.M.

FOR SALE: Friden Flexowriter Programmatic (like SPS) 8 level paper tape reader and punch using RCA 301 code. 15" carriage, Pica upper case type. Good condition with schematic and instruction booklet, $195 plus shipping. David Cain, 6724 S. Willow St., Englewood, CO 80110, (303) 771-8420 after 6 P.M.

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WANTED: Datapoint 2200 processor version 2 for reasonable price, used. Send details by Air Mail to Carl DuBois, Nasuli, Malaybalay, Bukidnon 8201 Philippines.

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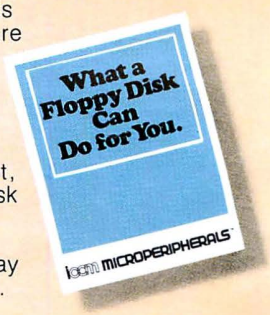

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UP AND RUNNING

TDL EQUIPMENT USED BY NEW JERSEY PUBLIC TELEVISION TO PROCESS NEW JERSEY GUBERNATORIAL PRIMARY ELECTION RETURNS

John Montagna, computer engineer (above left), lead this successful network team in generating election results speedily, efficiently and reliably using predominantly TDL hardware and software. Montagna created three programs to get the job done. The text for a SWAPPER program was written and assembled using the TDL TEXT EDITOR and Z80 RELOCATING MACRO ASSEMBLER. The SWAPPER text and all debugging was run through TDL's ZAPPLE MONITOR. The relocatable object code was punched onto paper tape. A MAIN USERS program updated votes and controlled air display. An ALTERNATE USERS program got hard copy out and votes in. The latter two programs were written in BASIC. Montagna modified the ZAPPLE BASIC to permit time-sharing between the two USERS programs.

Four screens were incorporated, two terminals entered votes as they came in and were used to call back votes to check accuracy. Montagna called on the power and flexibility offered by TDL's ZPU board and three Z-16 Memory boards.

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